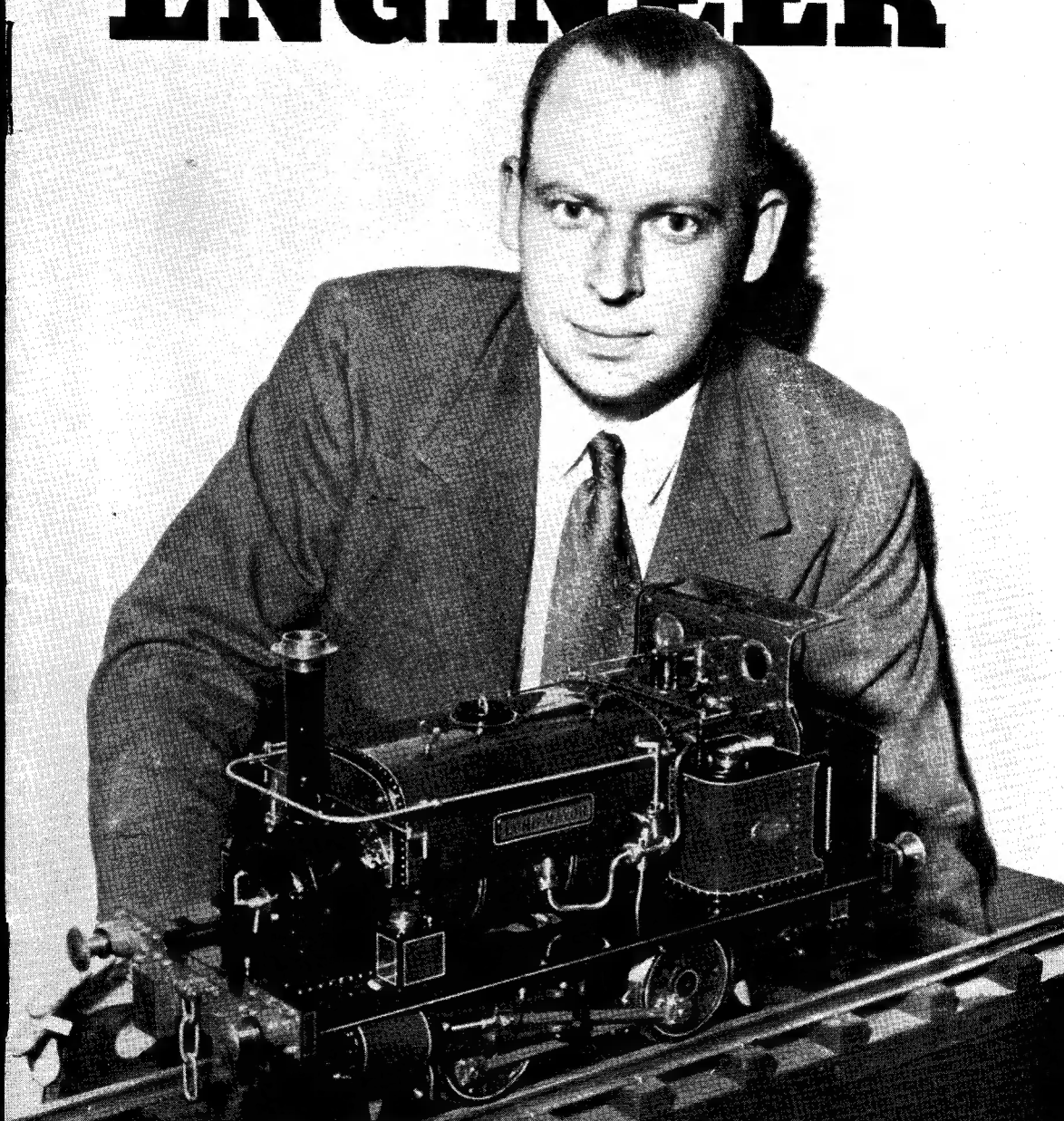
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● ELSEWHERE IN this issue will be found the story of the construction of the winner of the Locomotive Championship Cup at this year's " M.E." Exhibition. Our cover picture shows the builder, Mr. P. J. Dupen, with the little engine, and we now leave him to tell the fascinating story in his own words.

A National Register of Model Railways

● AS SOME of our readers will have heard, the Model Railway Club is preparing a national list, arranged by counties or districts, of layout owners who would welcome visits by appointment from other modellers staying in or passing through their neighbourhood. It was thought that a register of this kind would be appreciated by enthusiasts away from home on business, on holiday, or on service with the Forces—and judging by the response so far the idea has proved extremely popular.

The specifically model *railway* clubs have already been approached, but if the secretaries of model *engineering* clubs have any members who would like to be included in the register will they please send details to Mr. L. E. Carroll, 142, Harestone Valley Road, Caterham, Surrey, in the following form :—

1. Name, address and telephone number.
2. Times normally convenient for visits (evenings, week-ends, etc.).
3. Gauge and scale.
4. Power system (if electric, stating method of current collection—two-rail, outside or centre third, or stud-contact—and voltage, a.c. or d.c.)
5. Minimum radius.

Individuals are also invited to participate. Classification of replies will begin on October 1st, and all particulars should be sent by that date if possible, or during the following week at latest, so that publication of the register is not held up.

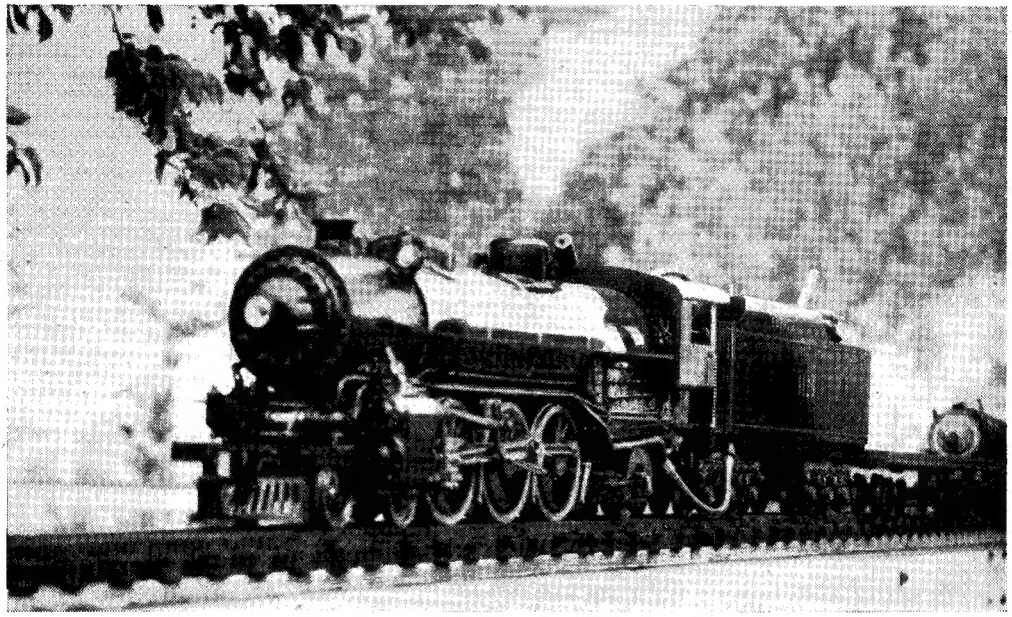
It is intended to send copies of the register free to all club members, secretaries and individuals who join in the scheme, and it will also be available to other modellers in return for a few pence. A further announcement will be made as soon as possible.

New Headquarters for the S.M.E.E.

● FOR ALMOST as long as we can remember, the Society of Model and Experimental Engineers has been seeking a home of its own. True, it has had its workshop at 20, Nassau Street, London, W.1, for many years, but here there was no accommodation for the holding of general meetings which have had to be held at one or other of the more convenient public halls in London.

Now, at long last, the much-needed headquarters have been found, and on Saturday, the 30th of this month, the premises, which are situated at 28, Wanless Road, Loughborough Junction, London, S.W.9, will be opened by the president, Lord Forres.

This very auspicious event in the society's long and honourable history must surely be regarded as a "red-letter day"; we take this opportunity of congratulating the society on its success and we offer our best wishes for the future. The scope now opening up for developing and enhancing the society's prestige and influence in model engineering matters is an important stepping-stone to even greater achievements than ever before.



No Interest

● AS A result of the publication of our recent paragraph under the heading of "An 'M.E.' Tie?", the number of letters we have received is precisely nine. They all favour the tie, whereas we invited readers to let us know what objections they would have to the idea! However, nine out of the grand total number of our readers is such an infinitesimally small percentage that we can only conclude that the matter is of no interest, or, at least, of nothing like sufficient interest to warrant our pursuing it any further.

An American Pacific

● THE PHOTOGRAPH reproduced on this page shows a fine 3½-in. gauge 4-6-2 locomotive of free-lance, but typical American design, built by Mr. Robert Stenholm, of Rockford, Illinois, U.S.A. The construction of this fine engine occupied spare time over a period of eight years, and it was obviously built to be an out-and-out *working* job rather than a scale reproduction of some particular prototype. It is, of course, a coal-burner, and it works at 100 p.s.i. boiler pressure. It is fitted with piston-valves operated by Walschaerts' gear; it has a steam water-pump which, as the photograph shows, is mounted on the pilot (cowcatcher), while the throttle and reverse controls are extended rearwards to the tender by means of flexible cables. When she was photographed, she was in steam on the track belonging to Bill Michaels at Racine, Wisconsin.

We feel that this engine should be something of an object-lesson to free-lance workers generally. She is not quite like any American locomotive known to us; yet she is typical of American Pacific locomotive design, and we are sure that she could be built to full-size dimensions and thereby produce a thoroughly serviceable and workmanlike engine that would meet the requirements of full-size practice. The point is that, free-lance or no, her proportions are *correct* and, with the exception of the whistle and the water connection between tender and engine, nothing would have to be altered. Would that the same could be said of most free-lance efforts!

We are sometimes accused of decrying, if not entirely condemning free-lance miniature locomotives, and we will not deny the accusation; but at the same time, we have nothing but praise for a free-lance engine which follows the *general principles* of locomotive design. Mr. Stenholm, to judge by the photograph, has achieved this; but another example which wins our unstinted approval is Mr. C. M. Keiller's fine ½-in. scale four-cylinder compound 4-6-0 engine, described so recently in these pages, which is another that, if reproduced full-size, would at once "look the part" and fit the loading-gauge. There is nothing in Mr. Keiller's engine that is out of proportion or offends a true locomotive lover, even if he dislikes the arrangement and details. Exceptions such as these—and we have met several of them—serve to strengthen our disapproval of the more usual sort of "free-lance" miniature locomotive, most examples of which serve only to show an utter disregard, or a complete lack of appreciation of locomotive proportions.

"LORD MAYOR"

An account of the construction of the Locomotive Championship Cup Winner at the "M.E." Exhibition, 1950

by P. J. Dupen

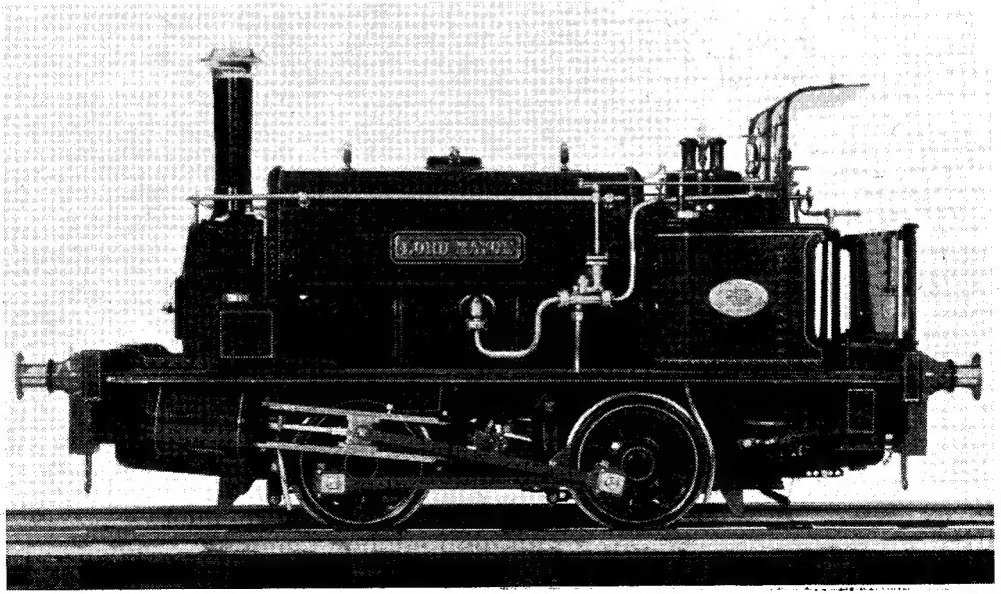
IT was in 1935 that the question of selecting a suitable prototype for a model locomotive came up. This is always a difficult problem and, at the time, my brother (the late W. A. Dupen) and myself put on paper several designs, including a 2½-in. gauge "Sandringham" class 4-6-0, a 3½-in. gauge G.W.R. 0-6-0 goods locomotive, together with several free-lance efforts. None of these, however, proved entirely satisfactory, as we wanted a model complete in detail, and, at the same time, it had to be a working job. The only solution to this problem was to build a model of a small type of locomotive to a large scale, if a large model and the attendant transport difficulties were to be avoided.

We were, however, fortunate in that, situated close to our workshop were the running sheds of the contractors C. J. Wills, who, for several years, had been engaged in building the L.C.C. housing estate at Dagenham, Essex. On this contract, they employed about eight saddle-tank contractors'-type locomotives, of various makes and types, 0-4-0 and 0-6-0, with both inside and outside cylinder arrangements. These were always kept in perfect condition, with their gleaming paintwork and polished brass and copper fittings, a striking contrast to many main-line locomotives, even in 1935, much less today.

We were naturally attracted to these locomotives, and when building operations came to a close the whole plant was put up for auction. Most of it was quickly disposed of, but one locomotive, however, an 0-4-0, built by Hudswell-Clarke, of Leeds, and named *Lord Mayor*, remained, standing on about 30 ft. of track in the centre of the field on which the auction had been held. We seized the opportunity to inspect this locomotive at close quarters. Here was the prototype we had been looking for, and one from which such a wealth of detail could be obtained. A word with the watchman revealed one snag; the locomotive was to be taken away in a week's time. However, armed with measuring-tape, rule, a notebook, and camera, we went about the task of measuring and making dimensional sketches of the complete locomotive, from the brass cap on the chimney to the number of rivets in the steps, rubbings being taken of such items as name and maker's plates, so that drawings of these could be produced at a later date.

A few details of the prototype may be of interest to readers, and are :—Hudswell-Clarke Builder's No. 402; Customer: Ship Canal Docks, Salford (later Manchester Ship Canal); Delivery date: July 3rd, 1893, Order date, June 24th, 1893; Cylinder bore: 10 in., stroke, 16 in.; Wheel diameter: 2 ft. 9 in.; Wheelbase: 5 ft. 6 in.; Working pressure: 140 lb. sq. in.; Weight: 15 tons 15 cwts.

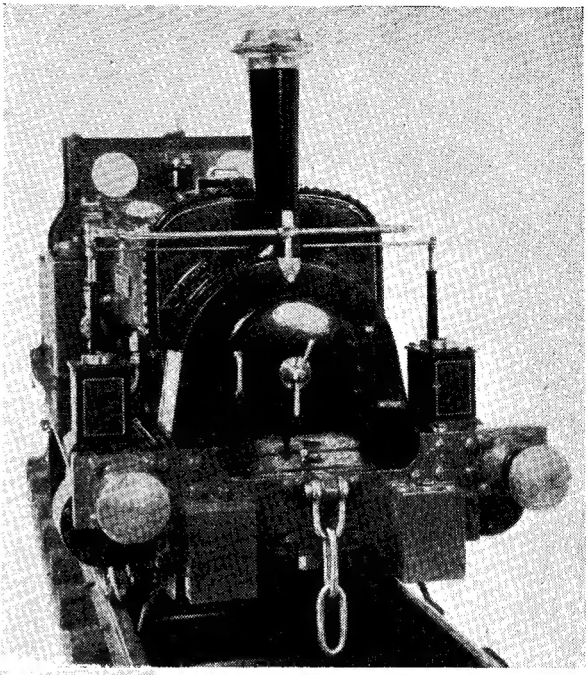
Note the short delivery date!

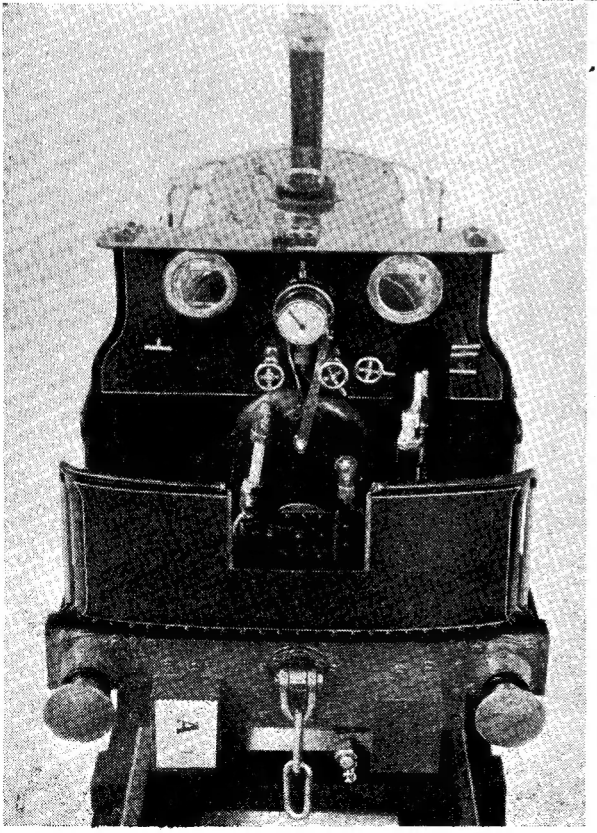


Having decided that this was a suitable prototype, it was a question of what scale should be adopted. In view of the small size of the actual locomotive, 1 in. to 1 ft. was considered suitable, and 5 in. accepted as the standard gauge.

Drawings were prepared for the main frames, buffer-beams, etc., and a start was made. My brother, at this time, was engaged in finishing a planing attachment for our 3-in. plain treadle lathe, while I commenced cutting out the frames from 3/32-in. B.M.S. The buffer-beams were cut from seasoned mahogany and faced with 1/32-in. steel, simulating the prototype. My brother, on completing the planing attachment, concentrated on the patterns, which had to be made for the wheels and cylinders, and also the formers for flanging the boiler plates.

At this stage, we both joined the recently-formed Romford Model Engineering Club, and as many readers are no doubt aware, the club commenced to build what was then to be the first continuous 2½-in. gauge track in this country. It was obviously no use building a 5-in. gauge locomotive when such a track was in progress. So, at this





stage, with very little progress made, *Lord Mayor* was put on the shelf, and a start made on a 2½-in. gauge G.N. 4-4-2 Atlantic type locomotive. This locomotive was a joint effort, my brother concentrating on the boiler and fittings, while I tackled the chassis. After three months' work, a steam trial was held on the Romford track, and the locomotive proved to be very successful; it has done much running over many years, and is now awaiting a much-needed overhaul.

As a break from model locomotive construction, our next job was a 4½ cu. ft. refrigerator, incorporating a twin-cylinder compressor, using sulphur dioxide as a refrigerant. This was completed in 1937 and is still running today.

No further progress was made with *Lord Mayor*, and during the war, the workshop was virtually closed down. Early in 1944, my brother was killed during one of the raids on London.

It was not until 1946, when one day, turning out oddments in the workshop, a steamchest casting for *Lord Mayor* came to light. This was immediately chucked in the lathe and faced off; thus, having machined a steamchest casting, cylinders, etc., had to follow. So, after a lapse of many years, work on the locomotive was started once again.

As mentioned previously, it had been decided to build the model with as much detail as possible, which entailed a considerable amount of extra work

at times. An instance of this is the provision of locking-screws on the wheel tyres, which, on the prototype, have holes drilled and tapped between the spokes of the wheel from the inside of the rim, the drill just penetrating the tyre to ensure efficient locking. This procedure was, of course, impossible on the model, and as I did not like the idea of drilling through from the wheel tread, it was decided to fit steel tyres ; the wheel rims could then be drilled and tapped from the outside. Tyres, which had first been machined from steel tube were shrunk in position in the approved manner, the locking screws and nuts being then fitted.

At this stage, the frames, wheels, cylinders, and boiler had been completed ; coupling- and connecting-rods followed. Owing to the design, i.e. split brasses held with gib and locking screws, and also the small section, the coupling-rods are only $\frac{1}{4}$ in. by $\frac{1}{16}$ in. These were practically cut from solid by hand, the only machining possible being the boring and facing of the brasses, when in position on the rods.

The valve-gear fitted to the prototype was Stephenson's link motion, with locomotive-type links. If this had been copied on the model, a valve travel of approximately 5/32 in. would have been the result, which was considered totally inadequate for a working model The valve-gear was therefore completely redesigned, incorporating launch-type links and a full-gear travel of $\frac{3}{8}$ in., giving a full gear cut-off of 85 per cent. The design was based on a series of articles by G. S. Willoughby published in the " M.E." during 1937, and I consider these to be the finest notes ever published on the Stephenson valve-gear. The result is a locomotive with perfectly even beats in either direction, and one that can be well notched up.

The smokebox is of stainless steel, and caused no difficulty after a bending machine had been made for forming the angle-brass used for securing the wrapper to the front and back plates.

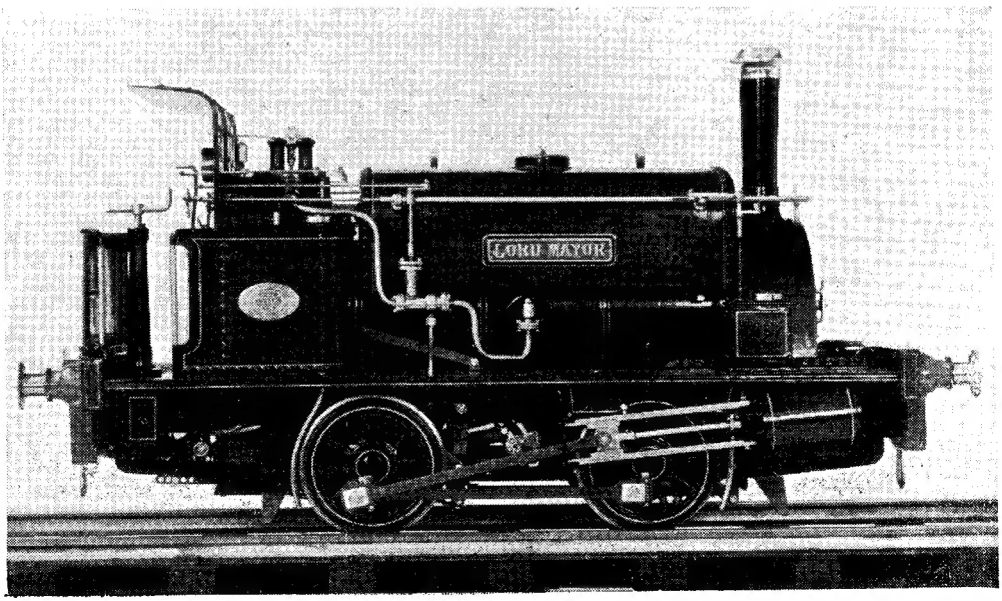
While on the subject of angle-brass, I would mention that the commercial drawn angle used on the model had a radius filed at the edge of each leg, to come in line with the rolled-steel section used on the prototype. The finished appearance well repays the extra time this takes.

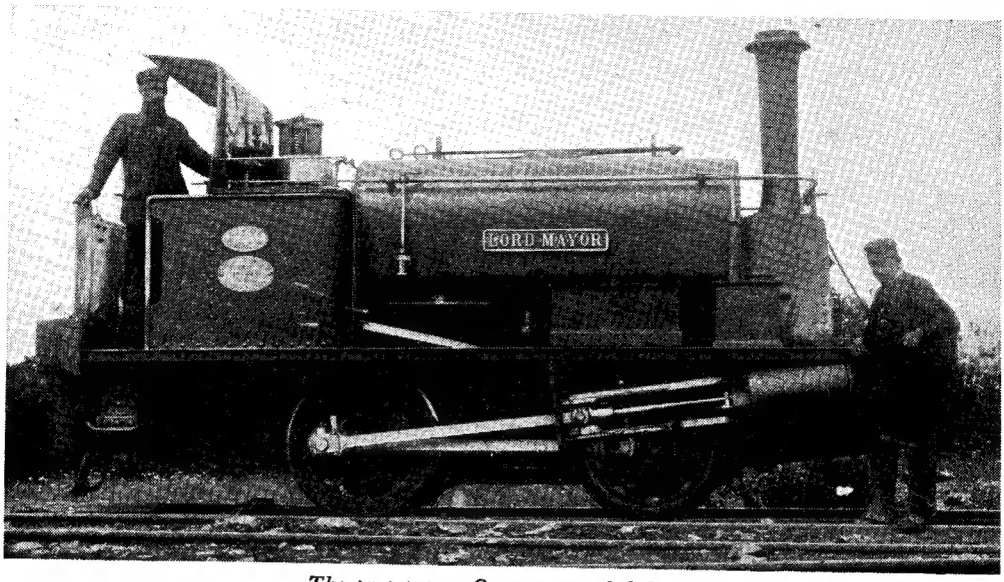
Sheet-copper was used for the construction of the saddle-tank and, owing to the difficulty of forming satisfactory snap heads on rivets when using soft sheet copper, it was necessary to head all the rivets on the inside. This was a rather difficult operation at the reverse bends at the base of the tank.

It was originally intended to feed the boiler by means of injectors only. This was rather a forlorn hope, however, but two injectors were made up. The external appearance was as close as possible to that of the prototype, the nearside one being an automatic type while the other was plain. These worked quite satisfactorily while the water in the saddle-tank was cold ; but after a few minutes running, the temperature of the water rose to such an extent that the idea of relying on injectors alone was abandoned. Even with $\frac{1}{4}$-in. lagging between the boiler and the tank the temperature of the water passed the range at which the injectors would give reliable service.

Several other ideas were considered, including a " Weir " type pump, to be located in the bunker. However, an axle-driven pump was finally fitted under the cab footplating and driven by means of a link from one of the valve eccentrics. This deals with water at the maximum temperature it attains in the saddle tank, a vertical hand pump being located in the bunker for emergency use.

A mechanical lubricator was mounted behind the front buffer-beam, to take care of the cylinder lubrication and was driven from the valve-gear. These items, together with a two-element super-





The prototype. See paragraph below

heater were, of course, not fitted to a locomotive built in 1893, and were, with the exception of the valve-gear, the only major departures from the prototype.

The provision of axle-driven and hand boiler feed pumps necessitated an additional clack on the boiler, and this was fitted instead of the test cocks on the boiler backhead. Otherwise, the cab layout is in line with that of the prototype, allowance being made for the out-of-scale fittings required for a working model.

Working brake-gear, dampers, cylinder cocks and sanding gear are fitted, the controls for all these items being arranged from the cab. The whistle was the only dummy on the engine.

Drawings for the name and makers' plate were produced from the rubbings mentioned previously, and photo-etchings of the correct size obtained. Buffers, couplings, etc., need no mention, except perhaps that no hooks are provided. As all wagons have hooks as well as chains, it was not considered necessary to fit these on the locomotives, for when two full-sized locomotives had to be coupled together, a "C" link was used. Each locomotive carried one of these, together with a short length of rail for use in the case of derailments which, on a contractor's track, are not unknown.

After preliminary steam trials in the workshop, several runs were made on the Romford Model Engineering Club's new multi-gauge track, and also on a continuous track. No difficulty was experienced in hauling four adults. On the continuous track, the fire requires frequent attention, and in view of the fact that the grate is only 1⅞ in. square, this is not surprising. A grate of this size may seem rather small for a 5-in. gauge locomotive, but as the firebox on this design is placed between the valve-gear eccentrics, this size is the maximum possible.

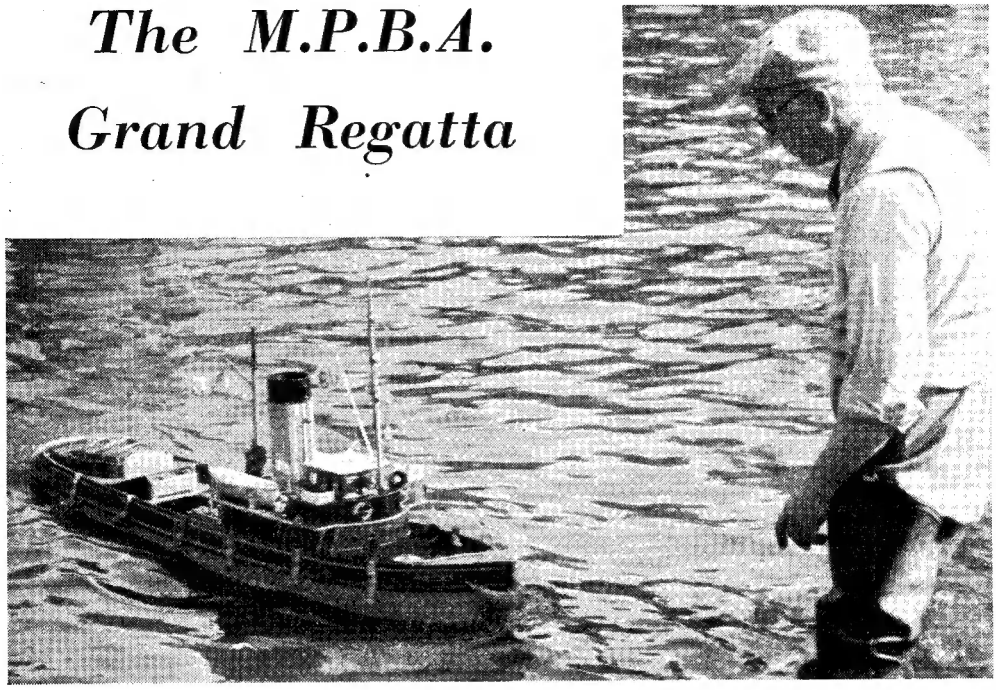
After satisfactory trials, the whole locomotive was stripped down for finishing and painting. Six coats of paint were applied to most parts, each one being well rubbed down, after which the lining was carried out with a ruling pen, followed by two coats of varnish. While this gives a satisfactory finish, it is extremely difficult to avoid some dust collecting on the surface during drying.

I can only say that the success attained in winning the Championship Cup was far in excess of my anticipation. I would, however, like to thank the stewards at the Exhibition for maintaining the model in excellent condition; and last but not least, my sympathy goes to the judges for their difficult task of selecting a model from such an excellent collection as was shown at this year's Exhibition.

[Soon after the announcement of Mr. Dupen's success was published, we received a letter from Mr. A. W. Leach, of Rhoose, Glamorgan, who sent us an interesting old photograph of the prototype *Lord Mayor*, taken at Somerton, Somerset, when the engine was being used on the construction of the Castle Carey-Langport cut-off on the Great Western Railway. Mr. Leach states that these little engines had to bounce (*i.e.* fly-shunt) four to five hundred 3-cu. yd. end-tip wagons each day of 10 hours; otherwise, C. J. Wills, contractor, quickly replaced the driver by one who would "keep her going." He learnt this from personal experience when helping to construct the Castle Cary line. *Lord Mayor* went later to assist in the construction of the railway from Birmingham to Henley-in-Arden.

We have included the photograph, which is dated 1904; comparison between it and the similar broadside of Mr. Dupen's model shows that, in thirty years, *Lord Mayor* was practically unaltered—a tribute to the soundness of her construction, considering the heavy nature of her job.—ED., "M.E."].

The M.P.B.A. Grand Regatta



Mr. A. Evans (Victoria) with his steam tug " Maycock "

THE Grand Regatta held by the Model Power Boat Association attracts an ever-larger entry as each year goes by.

This year's " Grand " held as usual on the day following the end of the " M.E." Exhibition once again broke all records for entries. No less than 77 straight running and 35 speed craft took part, and well over 20 different affiliated clubs were represented, including competitors from the well-known Tynemouth Club, who specialise in highly developed steering boats. This was their first appearance at Victoria Park, and they received a welcome from all.

This was one regatta that actually started *before* time ! This was possible as large numbers of boats and competitors had arrived nice and early, so that the first event was commenced at 10.45 a.m. instead of 11.0 a.m. Later arrivals who wished to run in this event—the 80 yd. Nomination Race—were able to join in after the actual start.

It would be impossible to attempt to describe all the varied types of boats taking part in this event, but it should be mentioned that almost every conceivable sort of prototype craft were represented—including a very realistic lifeboat from the Bedford Club.

The steering qualities of quite a number of the huge entry were rather poor, although in some cases weed was responsible.

The winner of the nomination was R. Beard (W. London) with his launch WL4, who returned a correct nomination, and runners-up were W. Allan, also of W. London, and A. Evans (Victoria) with *Maycock*.

Second event on the programme was a 500 yd. " C " Restricted Race for a new trophy presented by Messrs. " E.D." Ltd., and this race brought forth 13 entries ; about half of these were " D " Class boats, however, and none of these put up much of a show in spite of the fact that the line was changed for them.

G. Stone (Kingsmere) was running *Rodney* and *Lady Cynthia* in this race, but had no luck with either, but a boat new to regattas, Mr. Poyser's *Rumpus II* (Victoria) did 42.3 m.p.h. on one of his permitted runs and this was good enough to win, although several potentially faster boats were running in the race. N. Ridley (S. London) with *Marie* was second, and C. Stanworth (Bournville) third with *Meteor IV*.

While the last boats were having their runs in this race officials had been collecting the Class " B " competitors from the enclosure, so that apart from the change of lines there was hardly a break before the 500 yd. race for the " Mears Trophy " had commenced. F. Jutton (Guildford) with *Vesta II* was first on the line, but after a fine start *Vesta II* slowed down. The 5 laps were finished, however, but the average was 31.5 m.p.h. Upon examination it was found that the flash boiler had a leak, and this mishap caused *Vesta II* to be withdrawn from further part in the race.

B. Mitchell (Runcorn) put up his usual faultless performance with *Beta II* ; on both runs the

speed was exactly 46 m.p.h. This was bettered by G. Lines with *Sparky*, however, which on the first run achieved 53.3 m.p.h. A second attempt with this boat was unsuccessful, but the first run recorded the winning speed of the race. Third place was taken by T. Dalziel (Bournville) with *Naiad II*, 36.5 m.p.h. This boat is fascinating to watch as it rides with the stern very high out of the water. Two entries from the Coventry Club by Messrs. Robinson and Churcher were unable to complete the course on any of their attempts. The total entry for this race was eight boats.

Next on the programme was the officials' headache! The Steering Competition for the M.P.B.A. Steering Trophy; with 77 craft due to take 3 runs apiece it was a formidable task to avoid undue delays, but it was successfully accomplished.

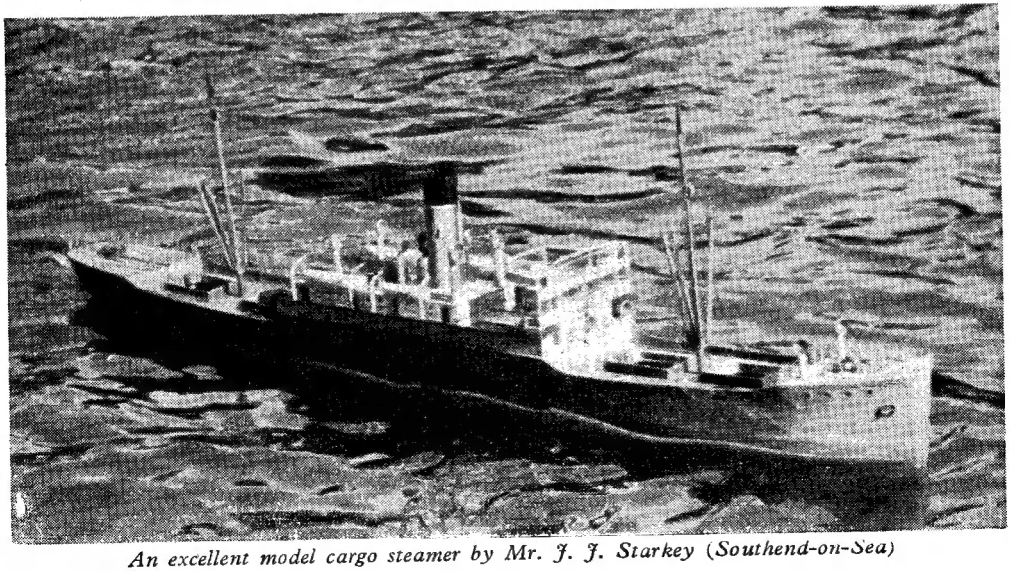
A stiff steering course of about 60 yd. in length and having targets only 4 ft. apart, ensured that at least, ties would not be plentiful; as it happened "ducks" were plentiful, but the aforementioned weed, which was stirred from the bottom of the lake by countless pairs of waders, was responsible in some cases.

The spectators, who had thronged the pondside all day were kept well entertained, as boat after boat took their run across to the targets, in fact there was hardly a moment when there was not a boat on the course.

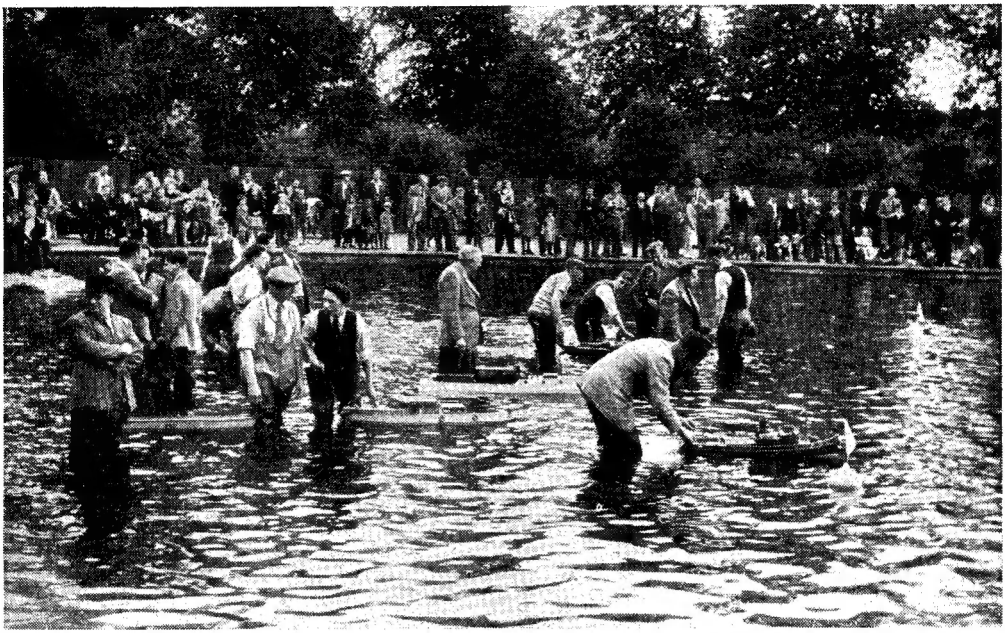
Mr. Irving of the Tynemouth Club was running two boats in the steering, *Joan* and *Alice*, and the former boat led for quite some time with one inner, one bull, and one outer, total 9 pts. However, B. Whiting with his steam launch *Eileen* also scored 9 and T. Curtis (Victoria) beat both these scores with the petrol launch *Micky*, two inners and a bull, 11 pts. On the re-run Mr. Irving's boat was successful against *Eileen*, thus placing him second.

Scores of 8 were made by E. W. Vanner (Victoria) and E. Walker (Kingsmere), 7 by F. Curtis (Kingsmere), 6 by J. Thomas (Blackheath), R. Brown (Victoria), and J. Jepson (Blackheath), while about 30 boats failed to score at all! During the straight running events two judges,

Mr. Poyser (Victoria) with "Rumpus II," winner of the "C" class (restricted) event



An excellent model cargo steamer by Mr. J. J. Starkey (Southend-on-Sea)



A few of the competitors in the steering competition in which nearly 80 boats took part

Dr. F. Machanik, of South Africa (West London club), with his ocean-going tug "Irena." (Winner of the Wellingham Cup at the "M.E." Exhibition)

Messrs. E. Bowness and H. B. Tucker, had been appraising the various prototype boats for the winner of the " M.E. Cup " this year, and their choice was R. Brown's *S. A. Everard.* Points were awarded for workmanship, steering, engine-room, realism, etc. in making their decision, and *S. A. Everard* scored a maximum in all cases.

Time was now getting on and there were still two speed events to be decided, but luckily these last races went off remarkable well. The 500 yd. Class " C " Race for the " Victory Cup," showed R. Mitchell's *Gamma* well up to the form with two good runs, the faster at 42.6 m.p.h. L. Barnes (Derby), with *Dagwood*, recorded 31 m.p.h. while R. Phillips (S. London) beat *Gamma's* speed by 0.7 m.p.h. to win the race. Messrs. Benson and Miles had no luck with their entries, and F. Walton's " D " Class boat managed 27.8 m.p.h. after an extremely slow first run.

Last race was the " A " Class Race for the " Speed Championship Cup," and this proved the most exciting of the speed races. The first three places were filled at over 50 m.p.h. for the first time since this trophy was awarded !

The race was decided on split seconds, the winners times being 19.4, 19.5 and 19.9 sec. respectively (52.7, 52.5 and 51.3 m.p.h.).

The winning performance was K. G. Williams *Faro* (Bournville), second was A. Cockman's flash steamer *Ifit 7*, while third place went to J. B. Innocent, with the evergreen *Betty.*

Strangely enough, all of these speeds were done on the first runs none of the boats bettering them on the second attempts. B. Miles with *Barracuda* the holder of the trophy did not finish with this boat, but managed 42 m.p.h. with *Typhoon.*

E. Clark (Victoria) had engine trouble with *Gordon 2*, and E. Walker and W. Parris had mechanical breakages before reaching the line! The other flash steamer in the race, B. Pilliner's *Ginger* (Southampton) was also in trouble, failing to complete a run on either attempt.

The "Crebbin Trophy" (awarded to the fastest flash-steamer) was easily won by *Ifit 7* for the fine performance in this race.

Full Results

Nomination Race 80 *yd.*—1st. W. Beard (W. London), *WL4*: nil per cent. error. 2nd W. Allan (W. London), *Elsie*: 1.3 per cent. error. 3rd A. Evans (Victoria), *Maycock*: 1.4 per cent. error.

"*C*" *Restricted Race* for "E.D. Trophy."—1st Mr. Poyser (Victoria), *Rumpus II*: 24.2 sec., 42.3 m.p.h. 2nd N. Ridley (S. London), *Marie*: 28.8 sec., 35.5 m.p.h. 3rd C. Stanworth (Bournville), *Meteor IV*: 30.5 sec., 33.5 m.p.h.

Class "*B*" *Race* for "Mears Trophy."—1st G. Lines (Orpington), *Sparky II*: 19.2 sec., 53.3 m.p.h. 2nd R. Mitchell (Runcorn), *Beta II*: 22.2 sec., 46.0 m.p.h. 3rd T. Dalziel (Bournville), *Naiad II*: 28 sec., 36.5 m.p.h.

Steering Competition for "M.P.B.A. Trophy."—1st T. Curtis (Victoria), *Micky*: 11 pts. 2nd Mr. Irving (Tynemouth), *Joan*: 9 + 3 pts. 3rd B. Whiting (Orpington), *Eileen*: 9 + 0 pts.

"*M.E.*" *Prototype Cup.*—R. Brown (Victoria), *S. A. Everard.*

Class "*C*" *Race* for "Victory Cup."—1st R. Phillips (S. London), *Foz*: 23.8 sec., 43 m.p.h. 2nd R. Mitchell (Runcorn), *Gamma*: 24.2 sec., 42.3 m.p.h. 3rd L. Barnes (Derby), *Dagwood*: 33 sec., 31 m.p.h.

Class "*A*" *Race* for "Speed Championship Trophy."—1st K. Williams (Bournville), *Faro*: 19.4 sec., 52.7 m.p.h. 2nd A. Cockman (Victoria) *Ifit 7*: 19.5 sec., 52.5 m.p.h. 3rd. J. Innocent (Victoria), *Betty*: 19.9 sec., 51.3 m.p.h.

Crebbin Trophy (for flash steamers).—A. Cockman (Victoria), *Ifit 7*, 52.5 m.p.h.

Model Power Boat Trials

by L. T. Cassanet

AFTER visiting most of the power boat regattas in Southern England, also the International meet at Derby recently, and conversing with power boat men and model car enthusiasts, I came to the conclusion that something more than an out and out speed contest was needed to keep up the interest of model engineers in our sport.

I, and I am sure all enthusiasts, would not like to see happen in our sport what has happened in other branches of model engineering, i.e. the man with the necessary money and contacts, winning all the prizes. It may not appear that this will happen, and probably not to the extent that it has happened in one branch I could name, but I do think in years to come it may. I therefore, got to thinking on the following lines.

Instead of so many speed events in the course of the year, why not make some of these into trials, similar to motor and motor cycle trials. This I am sure, would foster the art of making a craft, reliable, clean and pleasant to look at, as well as being fast, and it would urge model engineers to greater variety and development of ideas. The following points could form a basis to work on.

Trials to be held annually. All classes of boat to compete on equal terms, straight runners to have slightly varying rules and separate prizes.

Twenty points to be maximum, award for any one of the sections set a follow.

Hydroplanes

(*a*) General appearance, hull design and finish, eye appeal, engine layout, M.P.B.A. No. affixed, etc.

(*b*) Engine construction, whether own design and/or manufacture variations to a commercial engine; originality of design. This section could be incorporated in (*a*).

(*c*) Ease of starting, time limit on the line, points deducted overrunning of limit; in case of flash steam, special allowance to be made for getting up steam pressure.

(*d*) Speed over 500 yd. course, extra points for very fast laps.

(*e*) Ease of stopping, one lap after 500 yd. allowed for switching off. Boat to be considered stopped when engine stops, or in case of steam when lamps are out or whatever method is used for shutting down has been successfully operated. Points awarded for total time, start to finish.

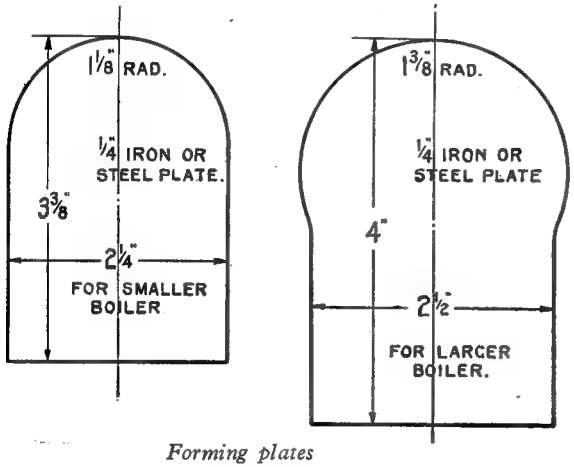
In the case of straight runners. Section (*a*) could be used, plus likeness to prototype. (*b*) to be used as it stands, (*c*) to be used as it stands including special allowance for type of plant. (*d*) points for steering one run only. (*e*) points for nomination.

I sincerely hope this starts a train of thought, and that someone will think sufficient of it to institute such a trial. I am hoping that my own club will do so. I am sure it would help to raise the general standard of performance at all regattas. It would also give the slow boat a fair chance to win something to show the "missus."

"L.B.S.C.'s" Beginners' Corner

Finishing off the "Tich" Boiler

I AM sorely afraid that those good folk—and there are many—who look to these notes for a little amusement as well as instruction, have been rather disappointed this last week or two; but the others who are building *Tich* and *Pamela* —and they *are* many!—naturally want to get on with the job. It is a puzzle to please everybody, but nobody can do more than their best, so please don't shoot. Well, *Tich* takes the stage this week, and we now have to fit the backhead and foundation ring, and do the final brazing job. By the time these notes appear in print, the weather should be a little more propitious, as it is the hottest job of the lot, and you don't need any help from the thermometer. No cause for alarm, I hasten to add; like the rest of the job, it is easy enough when you know how!



Forming plates

The first item needed, will be a forming plate for the backhead; and the accompanying illustrations will show the exact size to cut it, for either the larger or smaller boiler. Use ¼-in. iron or steel plate, unless you get a cast former from our approved advertisers; and proceed exactly as given for the firebox former. Lay the finished former on a piece of 13-gauge (3/32 in.) soft sheet copper, scribe a line $\frac{5}{16}$ in. from the edge, all around except at bottom, cut out the piece, and proceed to flange it over the former, same way as you did the end plates of the firebox. You'll find that the 13-gauge copper is easier to flange than the 16-gauge as it has less liability to crinkle or buckle; but anneal it immediately, if it should show any signs of "going hard." Any raggedness on the edge of the flange may be smoothed off with a file, or left, just as you please; it will be out of sight "for ever," and makes no difference to the efficiency of the boiler. But don't forget to clean the actual flange, leaving all the file scratches showing on the contact surface. Also, well clean the metal on the same side as the flange, for about ½ in. up from the bottom edge; this will ensure a good joint when the back section of the foundation ring is fitted.

How to Fit the Backhead

First of all, locate the hole for the lip of the firehole to come through. Measure from the inside of the top of the wrapper sheet, to the firehole; then measure from each side, also to the firehole. Transfer these measurements to the backhead; and mark from them, an oval of the same size as the outside of the lip of the firehole ring. Cut the hole, as previously described when dealing with the door-plate of the firebox; but this time, make the hole a little smaller at first kick-off. Now "offer up" the backhead, as the locomotive shopmen would say; that is, hold it in position against the wrapper, and see how the hole lines up with the lip of the firehole ring. You will see at a glance how much, and where, to file the hole, to make it fit just over the lip, when the backhead is in place. Enlarge the hole as indicated; clean all around inside the edge of the wrapper, put the backhead in position, with the lip of the ring coming through the hole, and then flange the lip over the edge of the hole, same as the doorplate end of the ring. Put a stout piece of square or rectangular iron bar in the bench vice, with the end projecting from the side of the jaws, for about 3 in. or so—don't forget the tip about taking out the steel inset jaws for this purpose—rest the inner side of the ring on the bar, and beat the lip outwards and downwards, until it is in close contact with the backhead, gripping same firmly and holding it against the shoulder of the ring.

The edge of the wrapper should bed nicely all around, against the flange of the backhead; if it doesn't, try gentle persuasion with a light hammer. However, by the general cussedness of things in this benighted world, there will probably be two or three places which refuse to close up. The best way to counteract this antic, is to drill a few No. 48 holes around the edge of the wrapper, carrying on right through the backhead flange, spacing them about 1 in. apart; then tap them 3/32 in. or 7 B.A., and screw in pieces of threaded copper wire, squeezing the plates into contact whilst doing this. The copper wire can be held in three-jaw, and the die in tailstock holder; wet the wire with cutting oil, as used for turning steel. Thread only about ¼ in. at a time, screw in the wire to the end of the thread, and snip it off flush with wrapper. Don't file it smooth until after the final brazing. I usually fix these

"persuaders" at about 1 in. centres, if I find them necessary, which isn't often. After fitting, tap down the edge of the wrapper between them, so that there will be no appreciable gaps between the wrapper edge and the backhead flange. Warning—don't, on any account, use brass screws for this job; I'll tell you why, in due course.

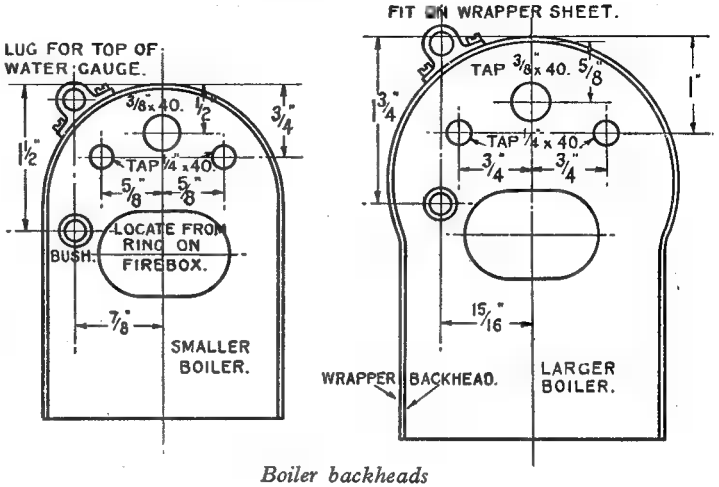
Foundation Ring

To finish the ring (some "ring"!) the spaces between the firebox, wrapper, and backhead, are filled up with pieces of ¼ in. square copper rod. This should be well cleaned. First cut a piece to fit the back end, between the backhead and firebox. This will go between the backhead flanges, and the corners should be rounded off, to fit closely in the curves of each flange. The edges should be bevelled off at each side, to form grooves for the brazing material to run in; see the black triangles on the drawings of both larger and smaller boilers. Knock in the piece of square rod, flush with the backhead at bottom; then drill three No. 51 holes clean through the lot—backhead, piece of rod, and firebox—and put in three $\frac{1}{16}$-in. copper rivets. If you haven't any long enough, use pieces of $\frac{1}{16}$-in. or 16-gauge soft copper wire, hammered over to form heads at each end. It doesn't matter a bean about forming fancy heads, as they can be filed flush after the final brazing.

The spaces between the firebox and wrapper, at each side, are filled up with similar pieces of ¼-in. square copper rod, bevelled off in similar fashion. The rivets can be put in at about ¾ in. centres; three each side should be plenty, as they are only to hold the parts together whilst being brazed. Tip—if there are any interstices at the ends of the bits of bar, where they join each other, fill them up with splinters of copper driven in, otherwise you'll have the brazing material running down inside, when it is nicely melted, and forming teardrops in the water space.

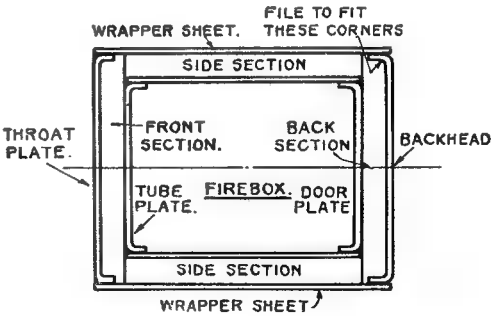
Bushes

A big bush will be needed on top of the boiler barrel, to carry the inner dome which houses the regulator. Two smaller ones are required, one each side of the boiler barrel near the smokebox, to take the feedwater clacks. I might here remind beginners, that cold feedwater should never be introduced into a boiler at the firebox end, but either at the smokebox end, as in the present instance, or else via top feeds on the barrel. It is all right to put the feed from an injector in at the firebox end, because that is always warm, by virtue of the jet of steam condensing in it. It would be advisable also, to put a bush in the backhead, for the bottom fitting of the water-gauge; although the 13-gauge copper is thick enough to take a thread, same is liable to strip very easily, in the event of anybody trying to get the last quarter-turn on the fitting, to enable the top and bottom parts of the water-gauge to line up properly. There is no fear of this with the regulator gland, you can stop turning as soon as it is tight.



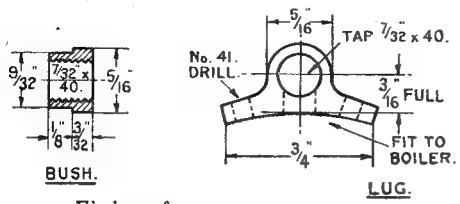
Boiler backheads

Wherever possible, bushes should be made either from thick-walled copper tube, when they are large, or copper rod when they are small. The metal from which plumbers' weldable fittings are made, is also very suitable; this is a kind of cast copper. The next best thing is bronze, either cast or drawn. Never use brass bushes in a boiler which has to be brazed or silver-soldered. Most of the "brass" rod sold, is an alloy known in the trade as "screw-rod," and is of a composition that allows it to take very clean screw threads (hence its name) but has a low melting point. I know of several cases where commercial "brass" screws have been used for fixing boiler backheads, and securing fittings to a boiler for brazing; and when the job was done, there were only holes left where the screws were originally. The heat of the brazing job had caused them, like the old soldiers in the song, to "simply fade away."



Foundation ring

Our approved advertisers should be able to supply either copper or bronze castings, or pieces of suitable tube, for the dome bush on either the larger or smaller boiler; and the method of turning it is exactly the same as given for the firehole ring, except that there is only one "step," and it doesn't have to be squeezed oval. Also, you know now, how to cut the hole for it in the boiler shell; so all that remains is to remind



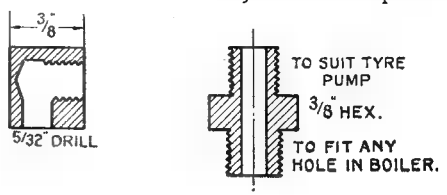
Fittings for water gauge

beginners to set the bush squarely in the hole in the barrel, so that the dome won't emulate the famous Leaning Tower of Pisa when the boiler is erected in the frames.

The holes for the smaller bushes are drilled 9/32 in. The bushes on the barrel should be on the centre-line, and both the same height; it looks bad when the engine is seen from front or back, and one clack box is higher than the other. To avoid this, stand the boiler on something level, putting a bit of wood, or anything else handy, under the barrel to keep it level; then, with a scribing block having the needle set to the height of the centre-line of boiler (easily "sighted" from the smokebox end) scribe a line along each side for an inch or so. At $\frac{7}{8}$ in. from the end of the boiler barrel, on each line, make a centre-pop; don't hit the punch hard enough to dent the barrel. Drill a $\frac{1}{8}$-in. pilot hole, and open out with a 9/32-in. drill. If you drill direct, you'll probably get an oversize polysided hole.

The location of the hole in the backhead, is shown in the illustration. The bushes are easily made; chuck the $\frac{5}{16}$-in. rod in three-jaw, face the end, and drill down for about 1 in. depth with $\frac{3}{16}$-in. drill. Tap 7/32 in. × 40. Turn a $\frac{1}{8}$-in. step at the end, to a tight fit in the holes in the boiler, and part off at a bare 3/32 in. from the shoulder. Make four of them, in case you spoil one. Reverse in chuck, and hold by the step; slightly countersink the end of the hole, skim the face truly, and run the tap through again. Squeeze them into the holes in the boiler.

On these small-diameter boilers, it is advisable to fit the water-gauge up straight, screwing the top fitting to a lug or boss on the wrapper; otherwise you cannot get a glass or reasonable length, and of sufficient diameter to obtain correct reading. A 5/32-in. glass is pretty reliable, but you have to allow for capillary attraction. If beginners don't know what that means, or what its effect is, try the following experiment. Take a short length of glass tube, 5/32-in. or $\frac{3}{16}$-in. diameter, and 3 in. or 4 in. long; dip it in a cup or glass of water, so as to wet the bore, let the water run out, and then dip it in the water again so that the end of the tube is about 1 in. below the surface. Those who are not wise to the effects of capillary attraction, will be surprised to see the water in the tube rise to about $\frac{1}{8}$ in. above the level of the water in the cup or glass. That is exactly what happens to the water in your boiler gauge; it is always very optimistic about the level in the boiler itself, and I always allow for it. I always try to arrange matters so that as long as you can see water in the glass tube, you are quite safe at either extreme; no chance of burning the crown sheet at low level, or excessive priming at



Adaptor for testing boiler

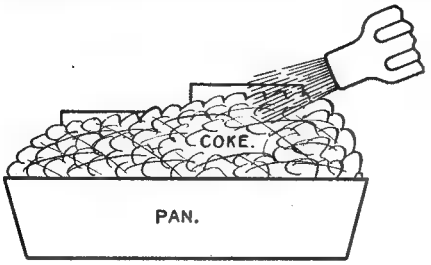
high level. Talking of priming, my boilers usually carry a "full pot" as the enginemen say, without priming, provided they are clean inside. The other evening I was running an engine after dark, put the injector on (it is a slow-feeding one) and was so busy watching the lights change on the automatic signals (kid with a new toy, says you!) that I forgot to shut it off at the proper time, and was only reminded of it when she started to throw water from the chimney. The injector knocked off of its own accord at the same time, through water going over with the steam; one of the troubles you get in full-size when the boiler is dirty and the engine starts priming, or foaming, as our cousins over the big pond call it.

In the present instance, the socket for the top fitting of the water-gauge is filed up from a small block of bronze, gunmetal, or copper; maybe our friends who supply the castings, may add this one to the list. The sizes are given in the illustration, and by this time I don't have to tell you any more, how to use a file! Drill a $\frac{3}{16}$-in. hole in the wrapper, close to the edge, and attach the fitting to the boiler shell, right over the hole, by a couple of screws, which are turned up from a bit of $\frac{3}{16}$-in. copper or bronze rod. Chuck in three-jaw, face the end, turn down $\frac{1}{4}$ in. length to 3/32 in. diameter, screw 3/32 in. or 7 B.A., part off $\frac{1}{8}$ in. from the shoulder, and slot the head with a hacksaw. The holes in the fitting are drilled No. 41, and the fitting itself used to locate the screw-holes in the boiler.

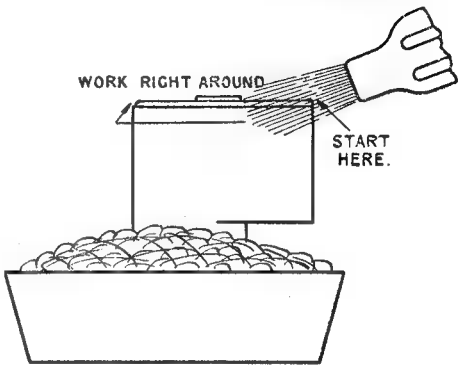
Final Brazing Job

Now we come to the job which will make you as thirsty as a certain Scottish gentleman who rejoiced in the name of Rab Noolas; and if you spell his moniker backwards, it will give you a clue to his trouble. Whilst this job can be done with easy-running brazing-strip, same as the previous brazing jobs, it would be easier for a beginner, or inexperienced coppersmith, to use a coarse-grade silver-solder, such as Johnson Matthey's B-6 alloy, or ordinary silver-solder of No. 3 grade, which is two parts brass and one part silver. With the former, use "Tenacity No. 1" as flux; with the latter, either Boron compo or powdered borax, mixed to a paste with water, as before. Both these materials only need a dull red heat to make them flow; and if only

a 2½-pint blowlamp, or equivalent air-gas blowpipe is available, this is an advantage, as there is now a considerable bulk of metal to heat up. Anyway, proceed as before ; cover all the joints with the wet flux, and lay the boiler on its back in the brazing pan, piling up the coke or breeze almost to the level of the foundation ring. If you have any asbestos cubes, fill the firebox with them, to protect the tube ends from the full force of the flame. If not, put in some bits of asbestos



Above : How to braze foundation ring



Right : How to braze backhead

millboard. Have all the necessaries handy, as this must be a non-stop operation.

Heat the whole lot evenly, to a dull red as before ; and when the coke glows, concentrate on one corner of the foundation ring, until it is hot enough to melt the strip of silver-solder, when it is applied to it. After that, proceed in the same way as the other previous jobs ; work your way slowly around, running in sufficient of the silver-solder to fill up the grooves where the bits of the ring were bevelled off. Pay particular attention to the rivet heads, giving each one a little dose of silver-solder all to itself, as they come within the flame. When you have been right around, and arrived at the starting point, give an extra blow, to ensure that the metal at the starting and finishing places properly amalgamates and forms a continuous run.

Don't give the boiler time to cool, but grab it with the tongs (the throatplate is the handiest place by which to hold it) and stand it up on end, with the backhead upwards. If there are any bits of coke sticking to the flux, which will be melted and tacky, play the flame on them for a few seconds, and if they don't fall off of their own freewill and accord, knock them off with the scratching wire. Then start blowing on the bottom corner, and go right around in the same way as the door-plate and tube-plate of the firebox were done. Should the blowlamp be on the weak side, and not powerful enough to heat the boiler without aid from the coke packing, try a finer grade of silver-solder ; but if still you cannot get it hot enough, the only thing will be, to pile the coke all around it to the level of the backhead. However, in the days when I used blowlamps, I never found this necessary, as the heat the boiler received when doing the foundation ring, was retained long enough to prevent the radiating away of heat from the blowlamp playing on the backhead joint. The firehole ring flange can be done by playing the flame direct on it, and using fine-grade silver-solder, or "Easyflo" ; same applies to the bush, and the lug for the water-gauge fitting.

Finally, stand the boiler right way up in the pan ; play directly on the dome bush, and as soon as it and the surrounding metal glows red, apply some fine-grade silver-solder, or "Easyflo." Give the two small bushes in the sides of the barrel, a dose of the same medicine ; then let the whole lot cool to black, and be mighty careful how you put it in the pickle, for it will emulate a volcanic geyser, or an explosion in a submarine, for a few seconds after being baptised. Leave it in the pickle for about half-an-hour this time, to get it thoroughly cleaned, and all the burnt flux dissolved ; then give it a good wash, inside and out, in running water, and clean up the outside as before.

Test for "Pinholes"

The easiest way to test for any weeny leaks in the brazed and silver-soldered joints, is by the same means as used for finding punctures in the inner tubes of cycle or car tyres. First of all, take a good look all around every joint, to make sure that there are no bits of burnt or glazed flux sticking to them. They might possibly cover a pinhole, and you wouldn't know anything about it until steaming up ; then the heat would melt the flux, out would come the steam and water, and a few new words might possibly be added to the dictionary of railroad Esperanto. Next, plug up all the holes except one, with screwed plugs (bits of wood would do, if you don't want to bother about turning up regular metal plugs) and cover the dome hole with a bit of sheet rubber, which might be cut from an old cycle tube. Put a piece of wood, or flat metal, over this, and hold it down with a cramp ; or if you have not got one big enough, tie it on with string wound over it and around the boiler barrel. Make an adapter to screw in the "excepted" hole ; the other end is screwed to fit a tyre pump. Incidentally, I keep an old motor tyre pump especially for jobs like these ; in place of the usual tyre-valve connection, it has a ¼ in. × 26 union nut and cone on the end of the hose, and adapters to fit any hole or bush, can be made in a few minutes.

Connect up the pump, put the boiler in a basin or pail of water, and pump about 20 lb. of air into it ; not more, as it is unstayed as yet, and

too much pressure would bulge the flat places. If there are any leaks, their position will easily be located by a stream of bubbles. If you happen to be unlucky, don't despair! Drill a No. 55 hole at each spot, tap 10 B.A., and screw in a stub of copper wire, with a smear of plumbers' jointing on the threads. Alternatively, the plug can be soldered over. In either case, the plug is filed flush after inserting it. If all O.K. we are now ready for the staying job; see next instalment of this serial.

"One Gaugers" Ahoy!

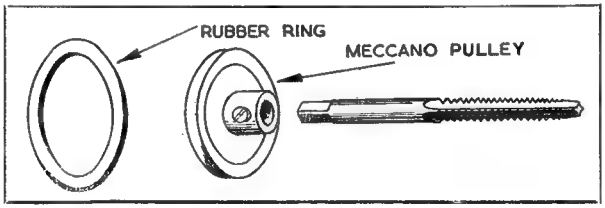
In the course of the correspondence about the 2½-in. gauge "election," I received several reminders that there are also plenty of good folk who, for various reasons, cannot go to anything bigger than 1¾ in. gauge, and would I please not forget them. The two recent "short stories" featuring the *Wee Dot Like Doris*, and her coal-fired sister, *Diana*, are proof that I haven't forgotten, so far; and from what advertisers tell me, the demand for castings and parts for these engines, has been pretty good. Incidentally, I have, at time of writing, just received a note of appreciation from a racing motor expert who built the *Wee Dot*, and is delighted with the way she does the doings, hauling a full load for half-a-mile non-stop with 70 lb. "on the clock" all the time. Says he wants some more gauge "1" "L.B.S.C." designs, and knows others who are of the same mind; and what about an express type of tank engine?

Well, I've "quite a basinful," as Bert Smiff would say, to get on with at the present time—got something "up my sleeve," too, which you'll know all about when the time comes—but I'll do my best, as I've always tried to do. Meantime, if anybody wanted an express tank engine "on the quick," they have only to take the frames, wheels, cylinders and motion, and inside boiler barrel of the *Wee Dot*, lengthen the frames to take a trailing bogie, use a parallel boiler barrel, put the superstructure of a Brighton Baltic tank on it, and you have a real nifty representation of one of Col. L. Billinton's masterpieces, which would run a Gauge "1" "Stockbrockers' Limited" in the manner usually observed by her big sisters on 4 ft. 8½ in. gauge, in the days before "Milly Amp" took the job on.

Let Your Taps Live Longer!

by "Yorkie"

IT can be assumed that many small hand taps suffer an early end before they have served a really useful working life. The following method of using small taps has proved so helpful, it was thought that the idea would be of considerable benefit to many model engineers, relieving, as it does, much of the small tap mortality and expense!



The tap wrenches supplied for the smaller size taps below, say, 8/16-in. Whitworth or 2 B.A. are always too big, and are inconvenient when using the smaller taps so frequently required in our hobby.

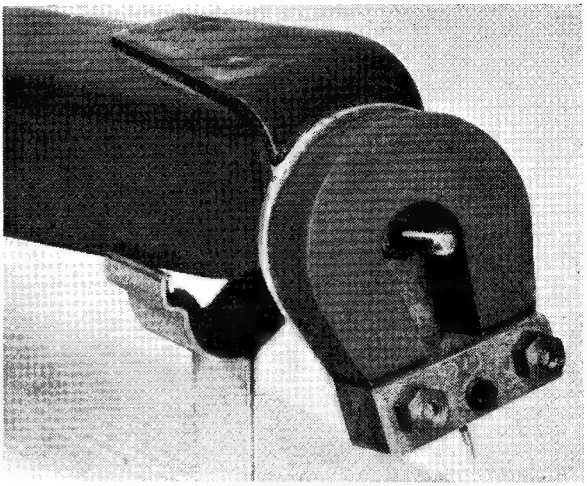
The two main causes of tap breakage (assuming the correct tapping drill has been used) are excessive leverage or torque, and the weight of the wrench; both these disadvantages are removed by the method to be described. It has a further advantage and an important one, that of time saving; the more commonly used taps can have these permanently fitted and are then always ready for use. As our good friend "L.B.S.C." has pointed out, every second saved is a second nearer the eagerly awaited testing time (of the locomotive, of course). You will have had your testing time when tapping those boiler-stay holes in soft copper, so take heart and adopt this scheme of tap equipment, when you will find your trials much reduced. Quite an important point about it, particularly in these days of high prices is the cheapness; so go ahead and obtain by buying or begging, a dozen or so Meccano pulley wheels, those about 1 in. in diameter, then visit the stationers and purchase a similar quantity of rubber rings as used on gent's umbrellas, costing about 2d. each; place one ring on each pulley and there you have your miniature tap wrenches all ready for use; the hole in the pulley is 5/32 in. diameter, so that all taps below this size can be accommodated. Let the set-screw bear on the round shank of the tap, then it will slip slightly if the tap tends to seize in the hole.

The circular shape is much more convenient in use; one can get a more even turning movement (or moment if you like), so fit up your taps, pull up your stool, light your pipe and get the stay holes tapped in that boiler right away with a quiet and peaceful mind! The sketch shows an exploded view of the arrangement; the rubber ring should be smaller than the pulley, so it requires stretching to get it on.

A Moving Coil Gramophone Pick-Up

by

A. M. Pollock



Pick-up head with cover removed

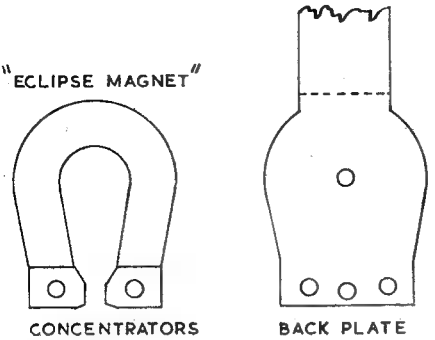
GRAMOPHONE enthusiasts are generally agreed that the standard (heavy) type of pick-up is unsuited to the high-fidelity reproduction of modern gramophone records. There are various reasons for this but they are outside the scope of this article. Suffice it to say that the essence of a high-fidelity pick-up is that it should have very lightly damped moving parts of the least possible mass and that the point pressure should also be as low as practicable. These qualities fortunately assist in reducing record wear very considerably and if miniature thorn needles are used in conjunction with such a pick-up, wear is reduced to an entirely negligible amount.

There are a number of different types of miniature lightweight pick-ups available and this article describes how to make one of them, a moving-coil pick-up. As with most things in this world, however, there is a price to pay for high quality results and the price in this case is a comparatively low voltage output that requires supplementary amplification before being fed into the usual gramophone amplifier. It does not provide sufficient output to supply the " pick-up " terminals on radio sets without a small connecting pre-amplifier, equipped with a bass-boosting circuit to compensate for the standard recording characteristic. This requirement is, however, fairly easily met by or with the aid of a gramophone enthusiast and the cost of making the pick-up so slight that it is, in the writer's opinion, well worth undertaking even with the most modest tools. As this article is intended to be of a constructional nature I will leave the preliminaries and pass to practical details.

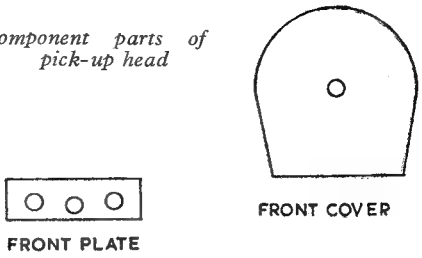
The pick-up is built round a small horse-shoe " Eclipse " magnet, such as can be bought from most tool dealers for about 2s. The pick-up head itself is made from 16-s.w.g. Duralumin. Commence by cutting out the back plate with a metal-cutting fretsaw. Fit a piece of $\frac{5}{16}$-in. square mild steel across the bottom of the plate to form the magnetic flux concentrators, as shown in the illustrations. Drill and tap the steel at each end with a 6 B.A. thread, drilling the back plate 6 B.A. clear, to register. Cut the steel bar in half and shape the inner ends as shown. The gap between the two halves should be as small as practicable and should concentrate the flux through the moving coil. A gap of 1/10 in. to $\frac{1}{8}$ in. is about right. A round-headed screw is passed through the back plate into each half of the concentrator, securing it in position.

The front plate is next cut out and drilled to go over the front of the concentrators. 6-B.A. nuts hold it. Holes, 1/10 in. dia. (No. 39), are now drilled in the front and back plates to take the moving-coil former. They should be midway between the concentrators and reasonably close to the lower edges. The holes should be squared off a little to receive the coil former. This should not be done any more than necessary to receive the coil former, with its rubber " bearings," as a tightish push fit and can therefore with advantage be left until the coil former is completed and ready for assembling.

The centre of the back plate is drilled and tapped 6 B.A. to take a stud to hold the front cover and a small clamping plate at the back for anchoring a light flexible screened lead, to which the two ends of the moving-coil are soldered. The stud is held by a lock-nut. The front cover and back clamping plate are held in position by nuts. Finally, the top half of the back plate is carefully bent back—on a sufficient radius to avoid rupture—so that the pick-up head is held by the tone arm at a trailing angle of approximately 75 deg. to the record surface. The exact angle to which the bend is made will depend on the height above the motor board of both the surface of the record on the turntable and the tone arm pivot post. Details are given below of a suitable tone arm for this purpose. A design for the supporting post has not been included because it was thought that many readers would already have an old one from a magnetic or other pick-up which they would prefer to adapt. If this item



Component parts of pick-up head



is not available, however, the reader's ingenuity will no doubt suggest a suitable mounting, giving free horizontal and vertical movement without backlash. A gimble type mounting would be satisfactory.

The coil former is made from plastic material which should be tough and fairly hard. The writer found an imitation ivory knitting needle of the thick variety, about ¼ in. dia., very satisfactory. The pliable, transparent kind will not do.

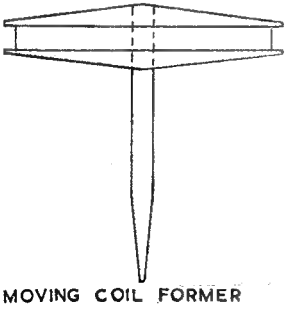
Drill through the centre of a section of the knitting needle, away from the tapering point, with a 32/1000 in. drill and reamer out to permit the finger-tight insertion of an H.M.V. Silent Stylus miniature needle sufficiently far to afford a firm grip. The black paint on the shaft of the needle should be scraped off before fitting so that the hole at this stage is kept as small as possible. Cut off the drilled section of the coil former, giving it a length $\frac{1}{16}$ in. beyond the overall outside dimension of the section of the concentrators plus the thicknesses of the front and back plates. The needle hole, will of course, be in the middle of the coil former.

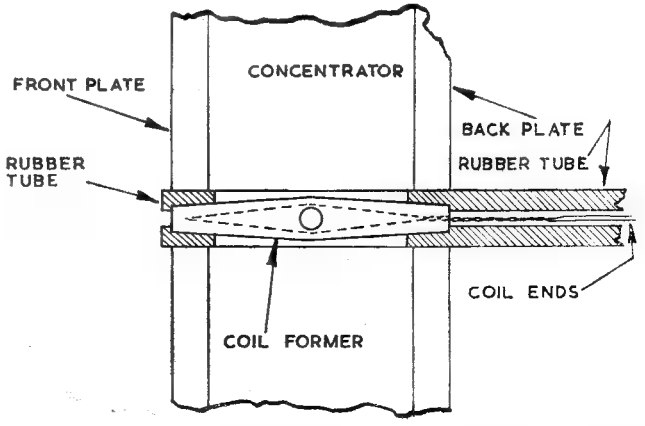
Insert a Silent Stylus needle or similar sized pin and hold the needle in a pin chuck. This will facilitate holding the coil former during the ensuing shaping. The coil former is shaped as shown in the sketches. The object is to make it as small as possible in all directions while retaining sufficient strength to prevent collapse if, for example, the pick-up is accidentally dropped on the record or turntable, and providing a recessed channel at each side and round the ends to take the winding. Fine tapered elliptical and square French files are very useful for this purpose. Each end of the former will need to be made sufficiently small to go into the holes, already drilled in the front and back plates, with a small sleeve or " bearing " of rubber to permit free but damped movement. It will be remembered that the slight squaring of these holes to facilitate assembly was being delayed until the former was finished. Suitable rubber tubing readily available is bicycle valve rubber of the transparent variety. The opaque type of reddish valve tubing is too hard and thick for the purpose. Only a very short section of tubing is required at the front plate end, but the back end piece should be left long enough to protect the fine coil ends which will be soldered to the flexible leads held by the back clamping plate.

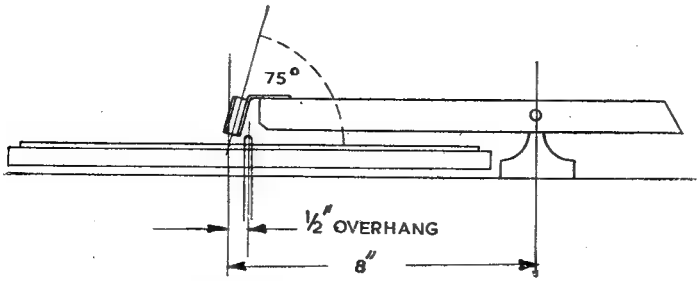
Winding the Coil

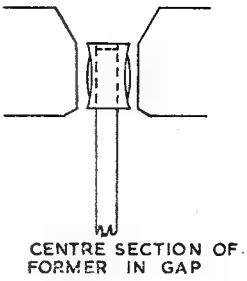
The coil itself is wound with about 4 ft. of 45-s.w.g. enamelled copper wire, giving a resistance of some 5 to 6 ohms. The winding can be done most simply by cutting off the right length of wire before starting. With a camel-hair brush apply a trace of shellac varnish to the former to hold the first strand. The varnish quickly gets tacky and when it does the wire can be pressed against it for a moment or two. A couple of inches of wire should be retained at each end to permit connection to the leads. Still holding the coil former in the pin chuck, wind on about half the

Right: Cross section of moving-coil assembly









Positioning of pick-up motor board

wire in the recess prepared for it, keeping the winding as flat ■ possible. Apply a small quantity of thin shellac varnish carrying away any excess on the brush. Complete the winding and gently twist together the two ends of the coil sufficiently to hold the upper one in place. Repeat the application of thin varnish as before and lay on one side to dry off quite hard. If the winding is swamped in varnish ■ skin will form and prevent the inside from drying for days. When dry, with ■ piece of fine emery-cloth gently clean the ends of the coil of their enamel, preparatory to soldering with resin-fluxed solder. The needle hole can at this stage be enlarged to permit the Silent Stylus needle to be finger-pressed to within ■ short distance of the upper surface of the coil former. It should not be allowed to go right through the former as this might result in subsequent loose- ■ with a slightly smaller needle than usual.

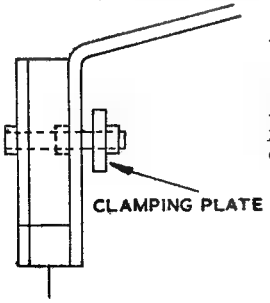
The rubber tubing is threaded over the ends of the former and of the coil ends. Still holding the coil former in the pin chuck, thread the long end of rubber tube through the hole in the back plate and, by means of the pin chuck, press the coil former firmly into its correct position. Place the front plate over the other end and press it down over the rubber. The assembly should be a tight enough fit to prevent the front plate remaining in contact with the concentrators when pressure is removed by the fingers. It should spring back slightly under the influence of the compressed rubber until held down by its nuts.

There should be adequate clearance between each half of the concentrator and the moving-coil assembly. The point of the needle should be capable of being oscillated between 1/32 in. and $\frac{1}{16}$ in. each side of the normal central position with light finger pressure and without any part of the coil former coming into contact with any part of the concentrators. If, after assembly, it is found that this requirement is not met, the pick-up should be taken apart and the gap widened by further filing of the concentrators. It should be remembered though that the wider the gap the less the output of the pick-up.

Pick-up Arm

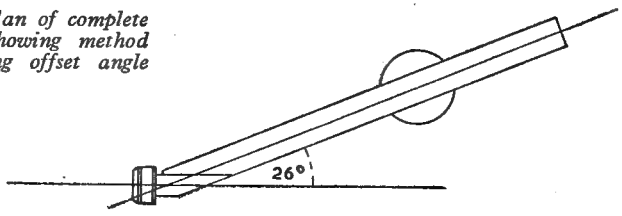
The pick-up arm can be made in ■ number of ways and the writer adopted an inverted " U " channel as being the simplest means of utilising an existing pivot and setting the correct offset tracking angle. Round tube could be employed equally well if it were to hand. Brass of fairly light gauge would probably be more convenient than aluminium as it could have any end and pivot fittings soldered on very easily. Whatever kind of arm is adopted it is essential that it be stiff enough to resist tortional resonance under playing conditions. A very light flat arm would, for this reason, not be satisfactory.

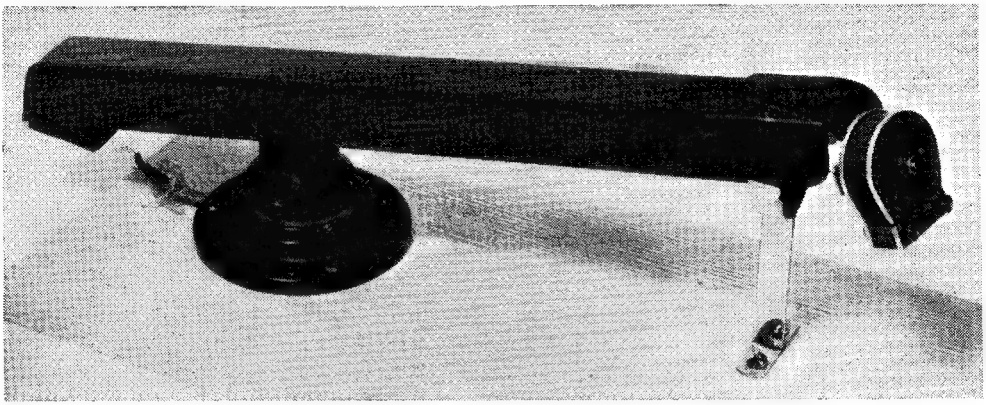
The " U " channel used by the writer was made from some 21-s.w.g. brass sheet that happened to be on hand, each of the three sides being a little under 1 in. wide. Small 18-s.w.g. brass plates were soldered each side of the arm on the inside to improve the bearings where the pivot pin went through the arm. The arm was made 11 in. long initially and drilled 6⅛ in. from the end to take the pivot pin. The end nearest the pivot was tapered off as shown in the sketch and the edges soldered together. It was drilled to accommodate a screw for the lead counterweight. At the other end of the arm the pick-up head is positioned at an offset angle of 22 deg. and the distance between the needle point and the pivot fixed at ■ in. The offset angle is the angle between the vibration axis of the moving-coil and a line joining the needle point and the pivot. With the pick-up arm described this angle is achieved by placing the pick-up head bracket at an angle of 26 deg. to the tone arm. The



Left : Side view of pick-up head

Right : Plan of complete pick-up, showing method of obtaining offset angle





Complete pick-up

angle between the pick-up head itself and its (integral) bracket will, of course, need to be made to give the desired trailing angle of 75 deg. between the record surface and the needle. When these inter-related angles have been adjusted the pick-up head can be screwed to the arm. It is convenient to tap the duralumin bracket and screw two screws through the arm from underneath filing them off flush when home. The overlapping part of the bracket should be trimmed off.

The pivot post should be fixed on the motor board in such a position that the "overhang" is ½ in. The overhang is the minimum distance between the centre of the turntable and the needle point when the pick-up arm is swung past the centre of the record. When the pick-up is in the "overhang position," it is on the far side of the centre of the turntable in relation to the pivot. The offset angle and the extent of the overhang vary with the length of the pick-up arm (needle-point to pivot centre) and are designed to reduce to a minimum tracking error distortion and record wear.

A counterweight should be fitted to the pivot end of the arm so that the weight on the needle point, in the playing position, is approximately ½ oz. A small spring balance can be used to check this. Finally, the arm can be painted a suitable colour to match the rest of the equipment.

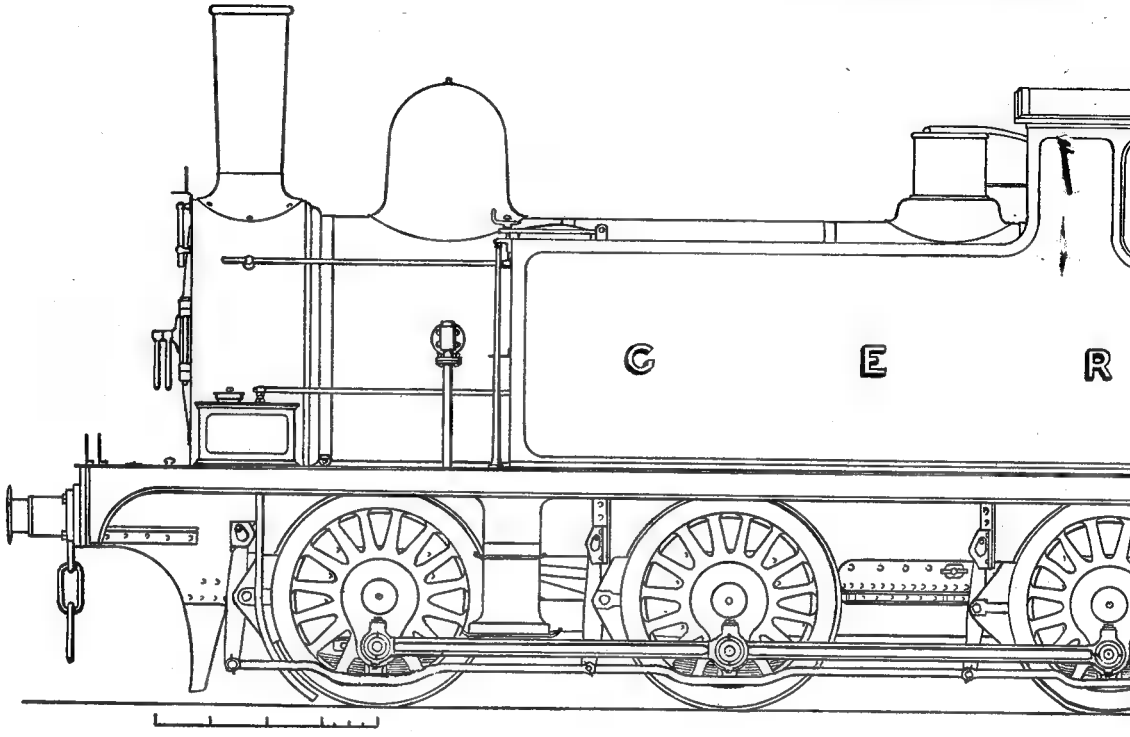
Owing to its low impedance a small input transformer must be used to connect the pick-up to its amplifier. The correct ratio is about 100 - 1. A transformer with a nickel-iron alloy core such as "Mu-Metal" is the best type to use and there are a number of war-surplus components about which can be bought very cheaply. In some cases otherwise suitable transformers are available with the wrong turns ratio and provided these have not been completely immersed in pitch, bakelite or other thermoplastic varnish and stoved, they can be taken apart and the windings cut off and removed. The bobbins can then be rewound with the proper ratio and the core replaced. With a "Mu-Metal" core a primary of 100 turns and a secondary of 10,000 is about right. Half the secondary should be wound on first, followed by the whole of the primary and then the second half of the secondary. This reduces leakage inductance and improves high-note response. The wire gauges to be used will depend on the winding space of the bobbin, but finer than 42-s.w.g. enamelled copper for the secondary is not recommended for amateur winding at home. 34-s.w.g. (D.S.C.) is suitable for the primary 100 turns.

If the reader does not feel up to making his own transformer he can buy one of the standard trade products (of the right ratio) marketed for low-impedance pick-ups and moving-coil microphones. A 200,000 ohm resistor (½-watt) should be connected across the secondary of the transformer and, as already mentioned in the beginning of this article, a standard bass-boosting circuit is necessary in the amplifier.

As will have been gathered, the needles are held by their push fit (finger-pressure only) and with the usual pivot height above the motor board, the pick-up head can be raised sufficiently before the back of the arm comes into contact with the motor board to permit the easy changing of needles. The writer uses miniature thorn needles exclusively, after a number of years' experience of most types including sapphire points, and has found it essential for the best results to take particular care to obtain a really fine point. If this is done up to four sides of (unworn) 12-in. records can be played without repointing and without audible deterioration using the latest type of almost distortionless amplifier and high grade speakers. It is appreciated, however, that many gramophone users will not go to the trouble entailed in "precision" sharpening of thorns and for them the miniature sapphire needle of good quality is very suitable. If sapphire or steel needles are used they must not be taken out of the pick-up until they are discarded at the end of their lives. To take such a needle out and later replace it would be liable to cause very severe record damage. If the reader has purchased Silent Stylus needles to help him make the pick-up in the manner suggested, the needles can, of course, be used afterwards. They will be suitable for high fidelity reproduction of up to some ten sides or so.

LOCOMOTIVES WORTH MODE

No. 34—Great Eastern 1



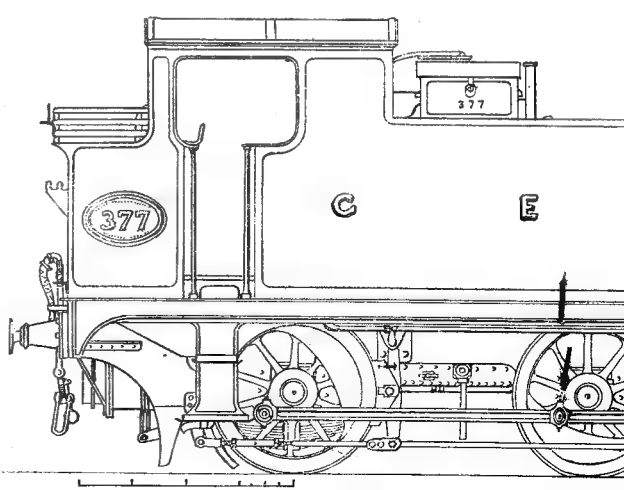
This is little No. 299, painted grey and with polished coupling-r shows the panelling, in black paint, of the tank ends,

DID you ever see a model locomotive finished in "shop grey?" What a strange idea! But wait—is it? On second thoughts one is inclined to think that the effect might be very pleasing.

Picture to yourself the little G.E.R. shunter which I have drawn specially for you to admire, painted a nice shade of medium grey, edged with a black border, a fine white line separating the two colours. Most attractive such a model would look, with her scale four-foot wheels and bright coupling-rods revolving gaily as she sped along your track.

When the first one of the fifty of these engines, No. 275, was finished at Stratford, in 1886, she was pushed out into the yard to be officially photographed. The cameraman, on this occasion, placed his camera so as to obtain a three-quarter front view. This was a rather unusual point of vantage in those days, most photographers choosing the bang-sideview position. Well, the picture turned out nicely, and it gave a clear record of how the fronts of the sidetanks were panelled in grey and black, that the red buffer-beam was edged with black, and how the two sandboxes were black in front and grey on their sides.

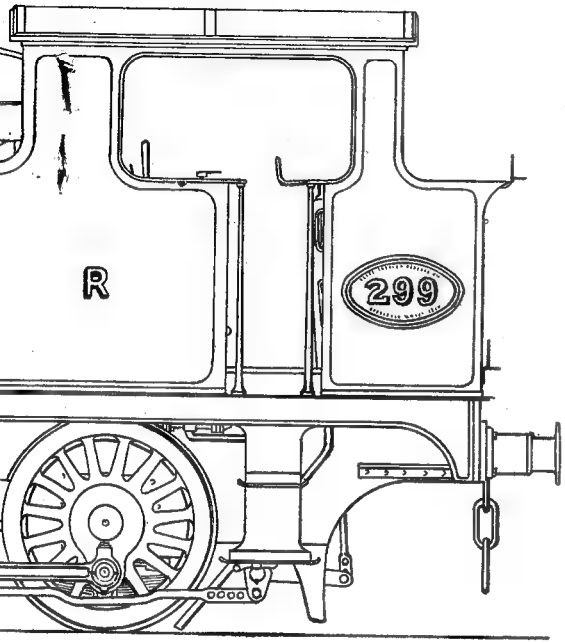
However, in the next year, James Holden had the new 299 put on the works' turntable, and photographed dead sideview. Standing there



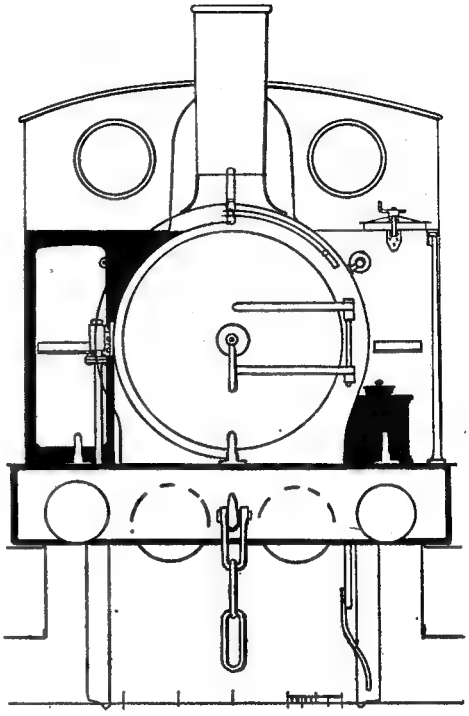
No. 377, painted dark blue, was a most

ODELLING by F. C. Hambleton

stern Railway—No. 299

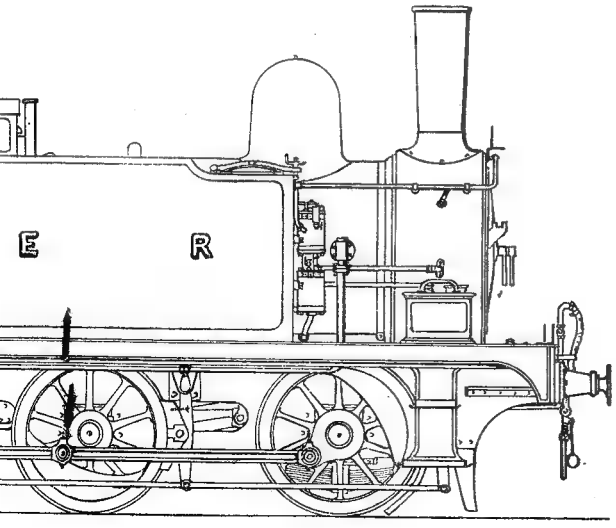


ed coupling-rods



Right—The front elevation of No. 299

e tank ends, and the sturdy appearance of the engine

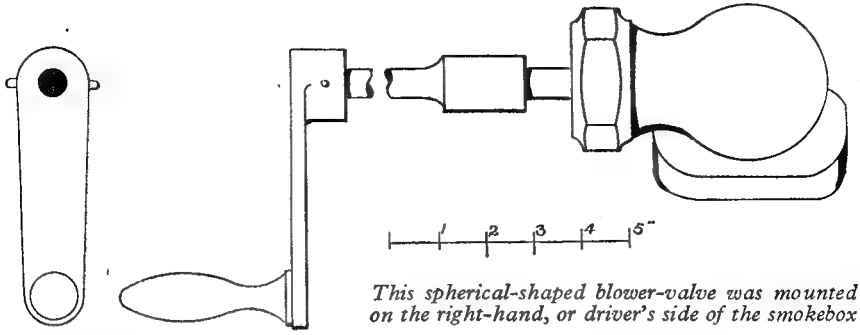


, was a most efficient little passenger engine

in the sun she made a pretty picture, smokebox and chimney gleaming black, and plenty of touches of polished metal to add the highlights. What a dear little basher! Basher?—Why, yes, of course! She was to bash countless wagons into all sorts of sidings for the whole of her long fifty years of life! How often have I stood and watched her hard at it! Puff! puff! swish!—and away would go a truck all alone into No. 2 road—and then, crash!—as it hit a string of its fellows quietly resting just round the curve.

Now, I am one of those chaps who have a particular affection for wagons—and goods trains in general. Trucks are so interesting, all very much alike, yet each with its own personality, like one's friends. And when one wagon crashes into another one, raising small clouds of iron rust dust about their frames, and setting buffers and metalwork all a-jingle, I feel slightly anxious. "Hope nothing's broken," one mutters. But quite unheeding, 299 is off again, tugging and straining at a tough set of resisting wagons. Puff! puff! puff! and so the merry rough-and-tumble proceeds.

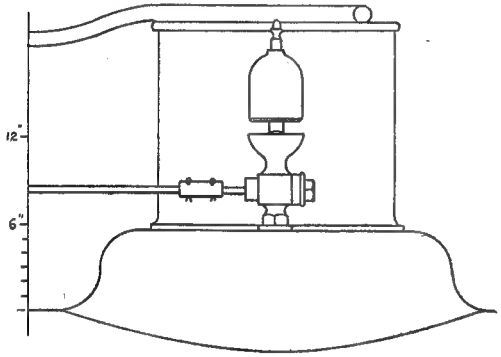
Of course, 299 was not grey for long (though I trust your model may remain so). She soon received her work-a-day coat of black paint, and the fine white lines which looked so pleasant against the grey, turned into red ones. But she did not lose her good looks, for if there was a



This spherical-shaped blower-valve was mounted on the right-hand, or driver's side of the smokebox

really beautiful colour for locomotives in the old days, well, then it was black. Not the black of today, mind you. Oh, no! In these hard times the full art of the "coach-painter" has had to cease. But in the nineties the loving care, the skill, the final coats of glorious varnish, made a black engine a joy to behold.

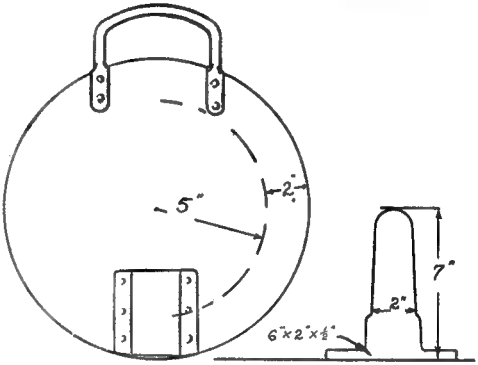
In 1889, another sister of No. 299—little 294 had an adventure. She was taken into shops and fitted with the Westinghouse brake. What



The G.E.R. whistle was placed at the side of the safety-valve casing

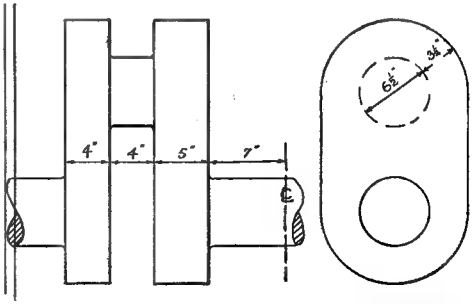
could this be for, she wondered? Why, to have a try-out on local passenger services, of course! She proved herself so good at this game, that from the next year onwards, no fewer than 160 engines of very similar design were hard at it on the tremendously busy G.E.R. suburban trains. How do you like the lines of No. 377? She was one of the 1895 gang—and a dear little gangster at that! Isn't she a sweet little thing? Being a "pass" engine, she was necessarily painted dark blue. How I wish I could adequately describe this lovely colour. What a pity it is that words cannot do this. Descriptions are powerless. One has heard the famous G.E.R. colour called dark blue, deep royal blue, cobalt, etc., etc. It doesn't get us far, alas! We could fly to the technical recipe for the making of this tint. But does anyone know of the magic formula? All I can do is to advise seekers after the G.E.R. blue to inspect the tender panels of the coloured plate of No. 10, issued as a supplement by *The Locomotive Magazine* in September, 1899. This is wonderfully realistic. 377 sported red coupling-rods, as all good G.E.R. engines did. (You remember 299 had bright ones when she was grey). And she had the black border and fine red line, together with the gilt letters, and brass numberplate with red background.

Thus, in the ranks of the 0-6-0 tank engines we have the choice of three colours, all most fascinating in their way. Let us return once more to the year 1887, and the grey No. 299. She had massive cast-iron wheels with 15 spokes,

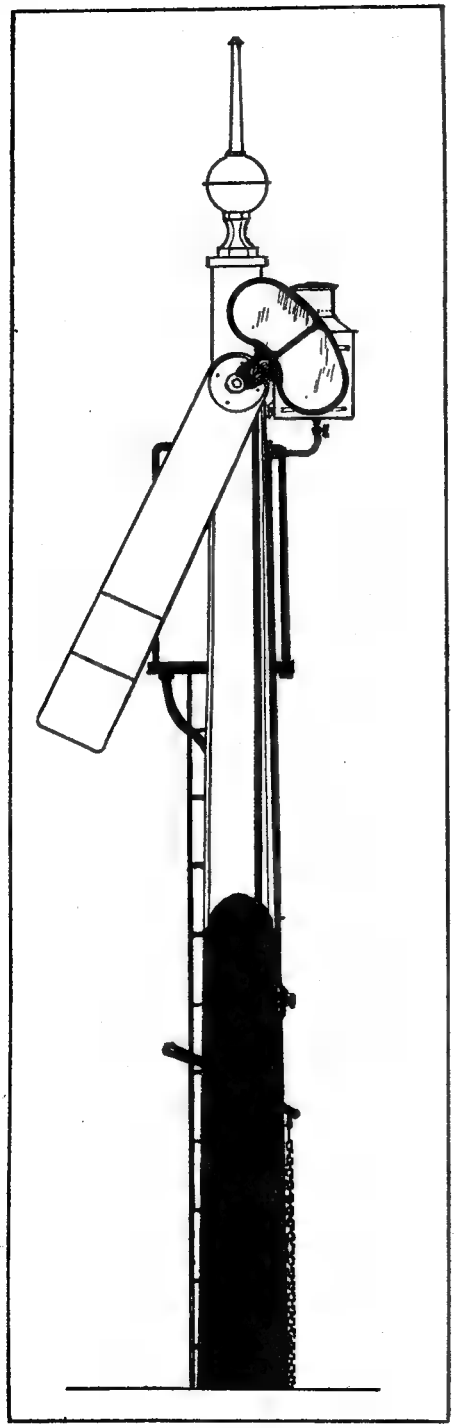


G.E.R. discs were white, or white with a green or red 10-in. spot. The three colours were likewise used in the headlamps

heavy 4-in. coupling-rods, and stout cranks, the inside webs of which measured 13½ in. by 5 in. in width! A few polished brass items; window frames, clackboxes, number plates, ornamental rim to the safety-valve casing, and curved cover over the front boiler angle-iron added interest. The whistle and blower-valve on the smokebox right-hand side are, of course, out of view in my



The cranks of No.299 were very sturdy affairs



Typical G.E.R. starting signal. This one had a 58-in. arm, placed 12 ft. 6 in. above its base

elevation. The latter was spherical in shape, with a neat little handle in the cab for the driver. This detail and many another (such as the heavy single slide bar and box crosshead) were really of T. W. Worsdell's design. And the blue paint was his, also. A fine, sound engineer was Mr. Worsdell. But then, had he not been works manager at Crewe for ten years, those ten momentous years when Webb was building his famous "Precedents," and the coal engines? Likewise, James Holden had had some 20 years' experience at Swindon. No wonder that when he adopted most of Worsdell's ideas on succeeding him as chief at Stratford, in July, 1885, and added some excellent items of his own, the G.E.R. engines were second to none! They were all well worth an official side-view photograph! How is it that so few of these side-view pictures are taken today? They look so fine, and are of priceless value to the locomotive historian. But now it is an age of "front views." Countless numbers of photographs of smokebox doors (plus a splasher almost on end) are taken—all very pictorial, one supposes, but monotonous and of little record value. Perhaps the 35 mm. miniature camera has had something to do with it. All the same, one sighs sometimes for the gentleman with the 10-lb. camera, a firm tripod, and those matchless very big plates, showing all the details crystal-clear. Fortunately, in a railway world, where all the older things are fast disappearing, and very fast at that, these little G.E.R. bashers are yet much in evidence. Thus we can go and examine their most interesting details at leisure. There are also a few of the excellent signals of the old line still standing here and there. These shapely things give the "right away" in no uncertain fashion, their arms dropping no less than some 64 degrees! The spectacle glasses were of the strangest hue imaginable, a very pale green, which at night, owing to the yellow colour of the flame of the lamp, appeared almost white! The pinnacles, too, were jolly, some of wood, and several patterns in cast-iron, or built up in zinc—making a pleasing variety. Oh! yes! we must have a sketch of one of these. Make it, good locomodeller, to put alongside your grey 299, and so capture the dear old G.E.R. atmosphere of Holden days.

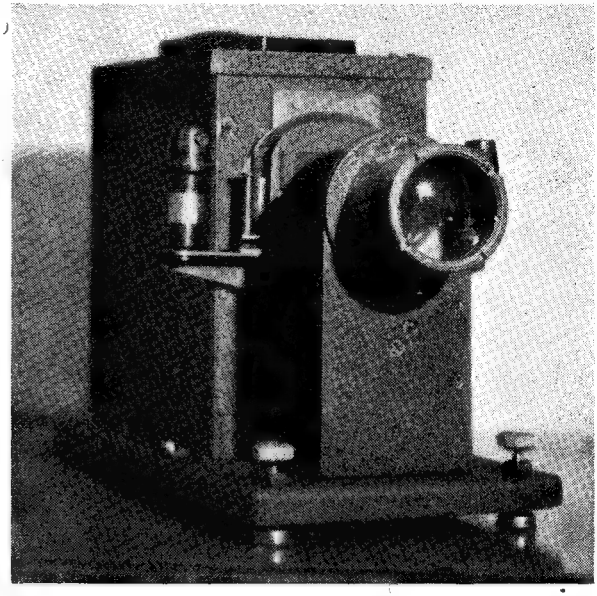
Useful Dimensions

Cylinders, 16½ by 22 in.
Centres of cylinders, 2 ft. 4 in.
Diameter of wheels, 4 ft. 0 in.
Wheelbase: 6 ft. 4 in. and 7 ft. 0 in.
Length over buffers, 28 ft. 2½ in.
Width over footplate, 8 ft. 4 in.
Width over cab, 7 ft. ■ in.
Centres of cab windows, 4 ft. 4 in.
Diameter of glass, 1 ft. 4 in.
Height of side tanks, 4 ft. 3 in.
Centre-line of boiler, 6 ft. 9 in.
Diameter of smokebox, 5 ft. 0 in.
Length of boiler, 9 ft. ■ in.
Outside diameter of boiler, 4 ft. 2 in.
Grate area, 12.4 sq. ft.
Working pressure, 140 lb.
Tank capacity, 1,000 gals.
Coal capacity, 2½ tons.
Total weight, 40¼ tons.

A 35 mm. Film Strip and Slide Projector

by

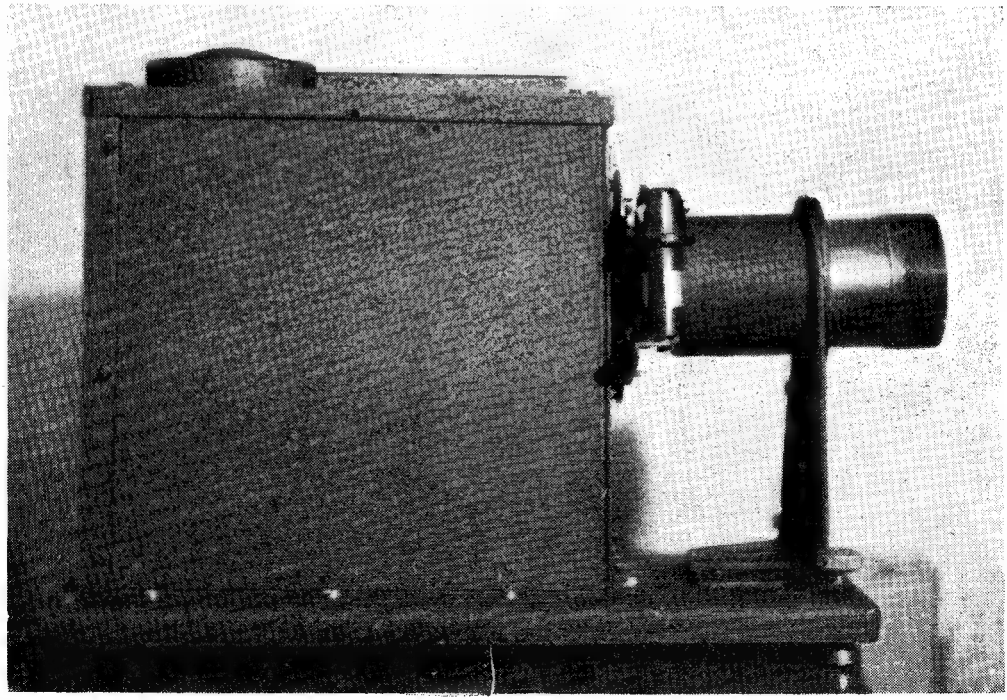
J. R. Russell

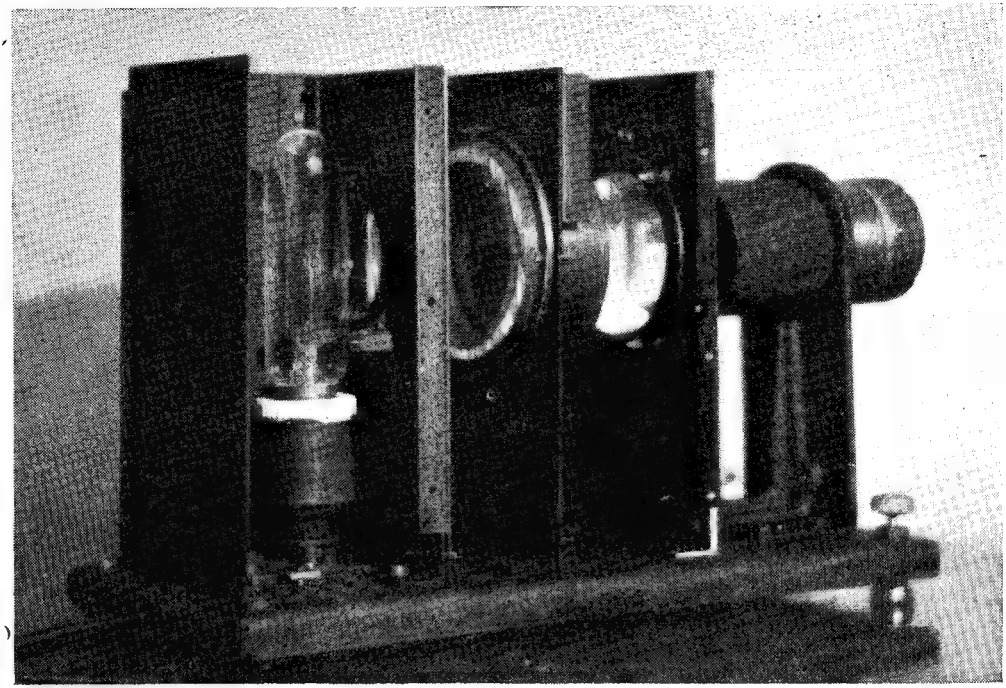


THE projector described and illustrated in this article was designed as a companion instrument to the "M.E." Episcope (THE MODEL ENGINEER, 42th Jun8, 1949 and 1st September, 1949). It is constructed mainly from ex-government surplus equipment, and costs less than £5 in all. The illuminant is a 12 V, 100 W tubular projector lamp supplied through a transformer.

The heart of the projector—the lens, was obtained through the advertisement pages of THE MODEL ENGINEER. It is a 35 mm. lens, f.1.9, with a focal length of 94.4 mm.

As sold, it was non-focusing, but a search of the local scrap yard produced some seamless iron tubing of the exact internal diameter required, and the lens body was fixed into this with c/s 6-B.A. screws. It proved impossible to obtain a suitable housing for this tube, so a length of 3 in. diameter dural was bored out to make a nice sliding fit. The assembly was then mounted on a piece of $\frac{1}{8}$-in. aluminium, bent up at right-angles, and stiffened with part of a cast





aluminium bracket, the whole secured to the projector base.

The base, also of $\frac{1}{8}$-in. aluminium, had a $\frac{1}{2}$ in. turn down all round to give extra stiffness. The lamp and condenser system was fixed to this base, which was mounted on aluminium panels, adjustable for optimum results. The complete assembly was then boxed in with 16-gauge aluminium, stiffened with $\frac{1}{2}$-in. aluminium angle.

The condenser system is very unorthodox, having a meniscus lens close to the lamp, the front assembly of a reflector gunsight next, and immediately behind the film gate, a $3\frac{1}{2}$ in. diameter double convex lens of unequal curvature —the flatter side forward. The whole forms an extremely efficient, although rather cumbersome arrangement.

The film strip carrier is constructed from $\frac{3}{4}$-in. brass angle, mounted on a $\frac{1}{16}$-in. brass disc, which is fixed to the front of the condenser housing, being free to rotate through 360 deg.

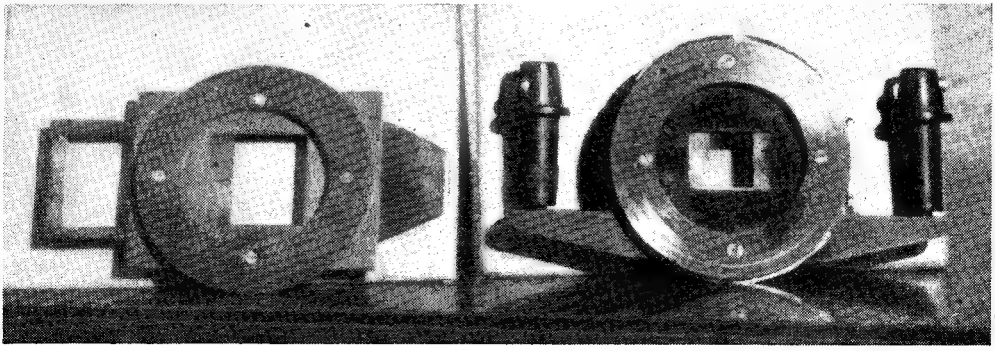
The film is carried on spools, turned from 1-in. ebonite rod. These spools incorporate spring-loaded detents, which prevent the spool coming off the spindle, and also provide sufficient friction for the spools to resist the springy film strip unwinding.

Film guides are fitted, also a lightly sprung glass "sandwich." Two sizes of mask have been made, for Leica and line film strips; these masks slip behind the rear pressure glass.

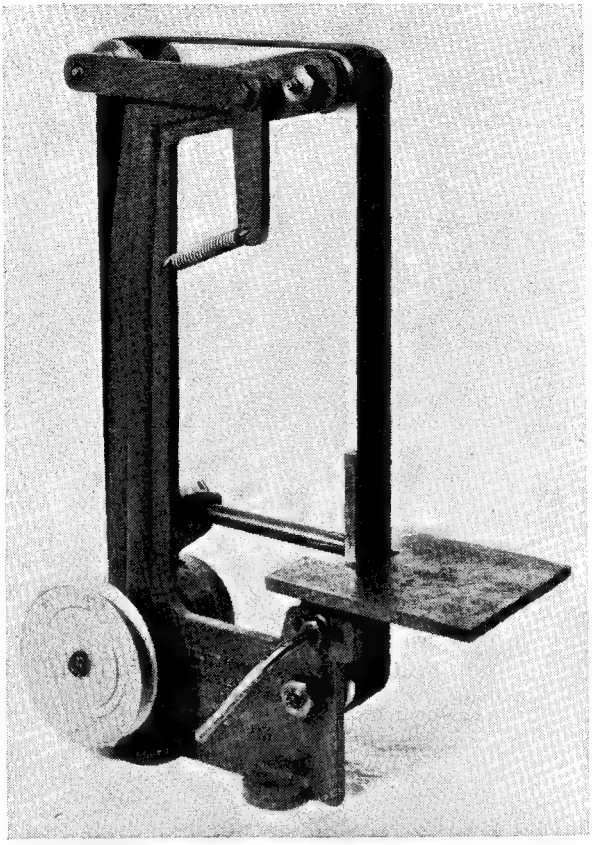
The slide holder is also mounted on a brass disc, which can be fitted in place of the film carrier. It is made from 18-gauge hard brass, and is of the shuttle type, slides being loaded each side alternately. Spring clips ensure that the slides are correctly positioned.

Two elevating screws were fitted to the base,

(*Continued on page* 490)



A New Abrasive Finishing Machine



MESSRS. HELLER & CO., 63a, Turnpike Lane, Hornsey, London, N., have recently introduced an ingenious vertical band abrasive machine, which is applicable to many purposes both in model engineering and light industrial work. The machine is intended for bench mounting and takes up very little space; it is provided with a pulley for vee belt drive either from a lineshaft or individual motor. It is suitable for finishing either metal or wood, using the appropriate abrasive bands in each case, and can be adapted to work either on round or flat surfaces, with provision for supporting the work at any required angle to the band.

The shaft of the driving pulley runs in two lead-bronze bushes in the main casting, and the three guide-pulleys for the band are also equipped with two bushes each, to run on fixed spindles, one of which is mounted on a spring-loaded arm to maintain tension on the band. Grease nipples are provided on all bearings for lubrication. The work table can be tilted and also shifted to or from the band, and is locked by means of a clamp lever. A vertical back support is provided for use when working on flat surfaces, and this is brought into contact with the inside of the band to prevent it deflecting under working load. For rounded surfaces, however, it is preferable to retract this support and allow the band to wrap round the work to some extent, thereby preventing the formation of flats. Concave curves can be finished by using the portion of the band which passes over the top pulley. It is possible to work to a fairly high degree of accuracy on square or angular surfaces by taking care in setting the table and back support, using a square or protractor in the former case.

This simple machine, which sells at a very low price, is capable of saving a great deal of time which would be taken in filing or hand polishing. It will take off a few thousandths of an inch from a metal surface, almost in as many seconds, and it is particularly applicable to such operations as removing the "flash" from castings or stampings, de-burring machined parts, and chamfering or rounding off corners. The abrasive bands can be changed in a few seconds, without using tools or dismantling any part of the machine, and spare bands with suitable grades of abrasive are available for producing any required standard of finish on metal, wood or plastics. We commend this useful machine to all model engineers.

A 35 mm. Slide Projector (*Continued from page* 489)

but sideways tilt can be corrected by the rotating film or slide holders.

The lamphouse and condenser sections are well ventilated by large holes in the base, and light trapped apertures in the lid, which, incidentally, is easily removable for lamp replacement.

The transformer, ex-Civil Defence stores, 100 V, 12 V, did not require any conversion, apart from fitting four rubber feet, a carrying handle and suitable sockets for the projector.

The instrument compares favourably with commercial models of a similar wattage. It has not been found necessary to fit a heat filter, a "frame" may be projected for 15-20 min. without becoming overheated. If desired, a heat filter of Chance Glass ON19 could be fitted, either between or before the condenser lenses, to enable a lamp of higher wattage to be used.

Practical Hints on Taper Plug Grinding

by "Scotia"

I HAD occasion recently to make a small ground-in cock for a friend in connection with a throttling governor he was making up, and though quite small this was highly successful.

In consequence of this, I am prompted to write these notes concerning work of this nature, not merely because the job was successful, but because of the fact that it is quite small. The bore was only ¼ in. at the small end of the taper, and just permitted me to carry out a dodge which I use quite often when making cocks of a larger variety in the course of employment.

This method utilises only one setting of taper and tailstock, and cuts out the long tedious business of "getting" the taper for the key or plug after the boring of the barrel. This can be especially troublesome on a lathe with no index plate, or one which lacks calibration. Although making no claim that the idea is original, I feel sure it is worth reviewing.

First of all, the plug is prepared in readiness for the taper by having the parallel diameter turned. Next, the body itself is machined completely, all branches being done prior to the turning of the tapered bore, as this is invariably done last.

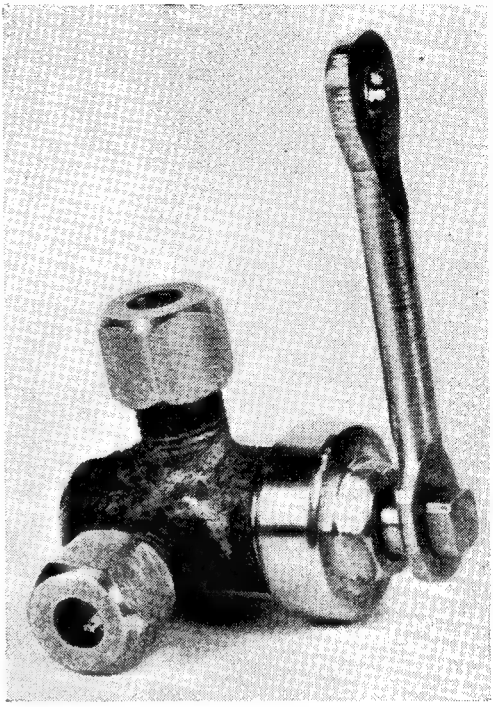


Photo by] [*W. Bell*

The unit complete

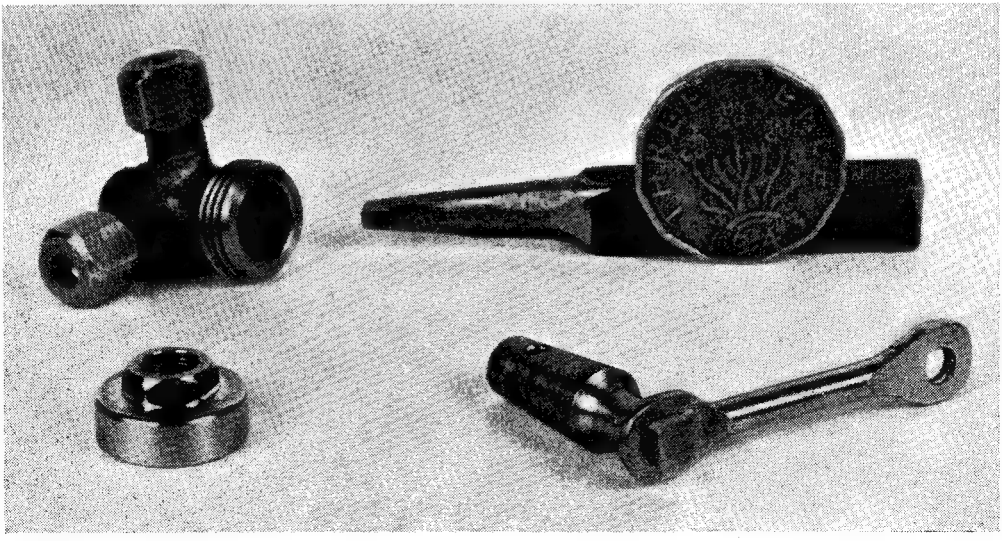


Photo by] [*W. Bel*

Photo showing assembly of the parts, and the boring tool

Tool Height

It is important that tool height is at centre for turning a taper, as, if it is high or low, a different taper is obtained, say for instance, from any previous known index reading on the saddle.

Having observed these elementary rules, the boring of the barrel is carried out. A second tool in keen condition is used for the last and " feather " cut, which should always be preceded

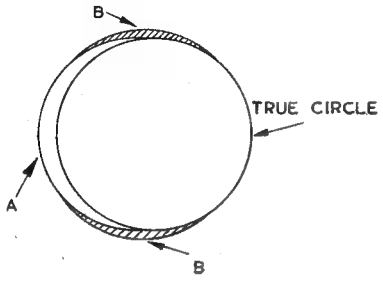


Fig. 1. Exaggerated view of bore, showing effect of unbalanced setting

by a slight easing of the chuck jaws in order to take the spring tension out of the casting. This last only applies when the work is gripped in a four-jaw chuck, and not when held in an angle or faceplate.

The valve body, now complete, is replaced by the plug, and with the lathe stationary, a line is drawn across the front or face of the plug with the tools used for the tapered bore. This line indicates the correct height which must be adhered to.

The rest is simple—having sharpened and reset the tools to the line just made, the lathe is set in motion—*in reverse*—the tools cutting the far side of plug, several cuts being made till the valve body fits snugly to correct length on the taper.

It will be readily understood that the method described cannot be undertaken on *very* small work, as tapered reamers would be more suitable for the body. In this connection, one cannot do better than look up " L.B.S.C.'s " very excellent description in THE MODEL ENGINEER dated October 28th, 1948, page 454, of how to make little plug cocks.

Rules on Grinding

Perhaps it would not be out of place to comment on some rules on the grinding of tapers. When passageways or ports are cast in the plug or body, no attempt should be made to grind them in the lathe. To do so is asking for trouble. The fitting only of the two parts is all that should be done on the lathe, the grinding in being done at the bench.

On the other hand, if there are no ports or passageways in either of the parts, they may be ground together in the lathe, care being taken against possible accidents by the parts locking while the lathe is in motion. The lathe should be run at a moderately low speed while grinding in.

Abrasives used by the writer are carborundum and oil, followed by fine sand and water, taking care to remove all traces of the former before applying the sand and water.

When a correct bearing is achieved the surface of the taper plug should have a sort of " brassy " or " old gold " look, and should have an even appearance of surface. If the body is held to the light, so that the beam strikes through the taper barrel showing it to be of even appearance, then it may be assumed to be O.K.

Balance

The question of balance is of paramount importance when setting up a valve body in the chuck, and tests should be carried out to find if any swing is apparent, and if so, the fitting of balance weights to counteract this is called for. A reduction of speed, where it is practicable to do so, often helps to eliminate any " swing " which may still be apparent.

The sketch, Fig. 1, shows an exaggerated view of the work turned out of true, due to unbalanced setting. The line *A* indicates the plane out of true with correct circle, the section *BB* indicating what must be removed to make a true circle, and which must have a correct bearing on the plug. This is a real nightmare for the man who will grind the parts together, with the possibility of failure at the end, owing to cast ports dropping out of alignment with each other.

Finally, a few necessary notes and hints to ensure success.

Frequent cleaning of the parts should be carried out while grinding, only one or two rubs of the abrasive being used before cleaning off and

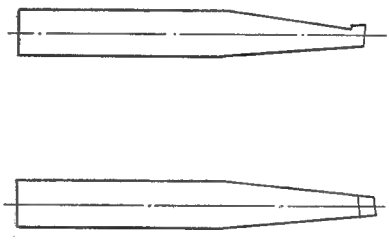


Fig. 2. Elevation and plan of boring tool. Note the taper ground on neck, ensuring maximum rigidity

applying a fresh dose. Keep well lubricated at all times, plenty of oil with the carborundum, and plenty of water with the sand. If a dry spot is allowed to develop it may well tear a circular groove in the plug or barrel, perhaps irretrievably losing the sealing qualities.

It is rather fascinating to make one's own fittings, and although the work just described calls for a certain amount of skill, it is quite possible to achieve a measure of success by following the simple rules outlined above, and in consequence I hope the foregoing remarks will prove of some value to readers.

Novices' Corner

Shaping Machine or Milling Machine?

STARTING with a collection of hand tools, the owner of the small workshop usually adds to his equipment as his interests grow and as expenditure can be met. Although, perhaps, additional tools and equipment are acquired from time to time, it is unlikely that finality will ever be reached, and the enthusiastic worker may be restrained only by lack of floor space from realising his ambitions to the full.

At some time, a stage is reached when it is decided that machine tools are essential for progress and, here, naturally a lathe is the first choice, for this machine when fully equipped is capable of carrying out all the ordinary machining operations required in the small workshop, including drilling, milling, and shaping of small parts. About this time, if not before, a drilling machine will have been purchased, as drilling operations may on occasion be awkward and slow when the lathe is used for this purpose.

It will, however, soon be discovered that a light lathe is not a very suitable tool for even moderately heavy milling with the ordinary form of circular milling cutter, nor can shaping operations readily be carried out on any but small parts; furthermore, when the lathe is used in these ways, much time may be occupied in setting up, and later removing, the necessary attachments. Quite often the outcome of this is that a decision is made to install a milling machine, or a shaping or planing machine; but, when the advice of experienced friends is sought, some will recommend one machine and some will say that the other is the better. The truth is, of course, that neither machine is the better, and the choice must depend primarily on the type of work normally undertaken, and on both the cost of the machine and the cost of equipping it, as well as that of maintaining its cutting tools in serviceable condition.

As the shaping machine and its counterpart, the small planing machine, are very much alike in their mode of construction and operation, the former only will be referred to and individual preference must decide the choice.

Lathe manufacturers, of course, see to it that their products have ample rigidity to serve the purposes for which they are designed, that is to say all ordinary turning and light milling operations. We say light milling, for to obtain satisfactory results and to take heavy cuts with circular milling cutters may require greater rigidity of construction than is found in many lathes. It is, of course, true that the ordinary lathe is fully capable of withstanding the stresses arising when, for example, milling the teeth of gear wheels of moderate pitch or cutting small keyways; but, when it comes to milling flat surfaces with a cutter having broad cutting edges, the result may be very different, and it may be found that chatter develops as soon as a cut of appreciable depth is taken. It cannot, therefore, be reasonably expected that a milling machine of no greater rigidity than the lathe will give appreciably better results. Therefore, when inspecting a milling machine, look first at the spindle and its bearings and see if they are more rigidly constructed than the corresponding parts of the lathe; next, examine the slides to ascertain if they are more massive and are specially constructed to withstand the stresses imposed by the cutter.

If you are accustomed to using the back gear when taking heavy cuts, you may feel the want of it in a milling machine not so equipped. To sum up: although the milling machine may be more convenient to use for many operations and will save having to set up the lathe specially for milling, except for light work, however, little additional benefit will be derived from a machine which is not superior to the light lathe in rigidity and robustness of construction.

Although occasionally hand-operated milling machines are used for special purposes in workshops where high-class hand work alone is undertaken; in general, milling machines are power-driven either by means of a self-contained electric motor or from a lineshaft.

Small shaping machines, on the other hand, are commonly hand-operated and the expense of a power drive is thereby saved.

The Drummond hand shaping machine, unfortunately no longer manufactured, was a very rigid and well-designed machine, capable, as we know from experience, of taking heavy cuts and doing very accurate work. This machine on its heavy cast-iron stand weighed some two hundredweights, and even a cursory examination suggested that neither money nor metal had been spared in producing an efficient machine tool. Some of the points to look for in a small shaping machine are: general rigidity, the weight of metal in the ram and its slides, as well as in the body casting and the work slides; also, the accurate fitting of all slides and the provisions made for the adjustment and lubrication of the working parts. The ram-head should be designed for angular setting, and the feedscrews should be furnished with adjustable index collars to facilitate quick and accurate machining.

The provision of an adjustable automatic traverse will also be found essential for many machining operations.

Power-driven shaping machines are necessarily more expensive, as both the driving mechanism and the ram adjusting gear are somewhat elaborate in order to render the machine convenient to operate. In the hand-operated machine the actuating lever is worked to and fro to move the tool over the full width of the work, but the

power-driven machine is furnished with a mechanism for setting the stroke to the required length ; moreover, an additional mechanism is needed to set the position of the ram in relation to the work so that the tool starts just short of the work and finishes its travel a little beyond the far edge.

Well-built machines of this type can be relied on to machine the work square and to produce flat surfaces to a high degree of accuracy.

Machining Practice

Now that some of the general constructional features of the miller and the shaper have been briefly described, the use of these machines in the small workshop may be considered.

As has already been pointed out, apart from the convenience of working, the milling machine, unless more rigidly constructed, will hardly be capable of doing heavier work than can be carried out in the lathe ; this applies also to the shaping machine, except that as a rule the sliding action of the single-point tool in this machine enables it to cut rather more freely than the revolving toothed cutter commonly used in the milling machine ; consequently, it will be found that more power is usually provided to drive a milling machine than is necessary for a shaping machine of equivalent capacity. In this connection, Professor Flather is quoted in Fowler's *Machinist's Pocket Book* as stating that the results of his experiments show that, for a given expenditure of horse-power, a lathe or planing machine will remove one and a half times the amount of metal removed by a milling machine.

Tools

The rather expensive circular cutters used in the milling machine are resharpened in a cutter grinding machine fitted with a device for accurately indexing the teeth, and, although it might quite well be possible to construct such a machine, this grinding operation is usually beyond the resources of the small workshop and has to be done elsewhere. As each tooth of the cutter has to be ground individually, the cost of resharpening a cutter may be by no means inconsiderable ; moreover, as in some types of cutters each tooth has three cutting edges, the cost may be even further increased.

As the cutter teeth are generally finished by grinding and not by honing, any roughness of the cutting edges will be reflected in the finish given to the work. This difficulty can, in part, be overcome by using an oilstone slip to smooth the cutting edges, but care must then be taken to stone the teeth evenly.

It is essential that the milling cutters should be mounted on the spindle of the machine to run truly, for any error of centring will mean that the brunt of the work falls on some of the teeth only, and the machining process will then be more nearly akin to fly-cutting. Fly-cutters can, of course, be used in the miller, but the machine will then be working at a reduced rate and will be operating in a manner well within the capacity of the ordinary lathe.

The shaping machine has the advantage in the small workshop that it can use the ordinary lathe tools, and these tools can be readily reground and their cutting edges afterwards honed to give a good finish to the work. Moreover, the value of the rake and clearance angles can be altered at will to suit various classes of materials such as wood, plastics, and all types of metals.

When employing the milling machine for forming V-slides or cutting T-slots, angular cutters or T-slot cutters respectively are generally used, but no special tools are required for carrying out these operations in the shaper.

The angular cutter acts as a form tool cutting on a broad surface and any inaccuracy of the cutting edges will be imparted to the work, but the pointed tool used for this purpose in the shaper is accurately guided by the tool-slide, and the small area of the tool's cutting edge in contact with the work will ensure free-cutting and but little tendency to chatter.

It might at first be thought that the shaper was inferior to the miller in the variety of work it could perform, but this is hardly true, for the shaper will cut long keyways and will form racks and gear wheels. For the latter purpose, a single-point form tool is used, and the gear blank is indexed either by employing dividing-heads mounted on the table of the machine, or by using a master gear wheel controlled by a suitable indexing detent. In the same way, multiple splines or keyways can be cut in a shaft. The miller is, however, superior and quicker in action when it comes to cutting profiles and forming curved surfaces.

Carbide-Tipped Tools

An operation commonly required in the workshop is to form flat surfaces on castings ; for example, machining the base casting of a drilling machine which is too cumbersome to mount conveniently in the lathe. This work can, however, be carried out quite well in the milling machine, but the hard surface scale will in some degree blunt the cutter used for the purpose, and will render it less well able to impart a good finish to subsequent work until it has been resharpened.

When castings are machined in the shaper, a carbide-tipped tool can be used and the cutting edge will be but little affected by the surface scale. This type of tool can be employed in the shaper for all general work on cast-iron and non-ferrous metals, and will but rarely require resharpening.

Carbide-tipped cutters are used commercially in milling machines, but their cost is prohibitive in the small workshop. A single, tipped tool might be used as a fly-cutter, but the carbide material is susceptible to shock and might easily be fractured by the force of the impact as the tool strikes the work when cutting intermittently.

Cost

Power-driven milling machines are relatively expensive, although the cost will, of course, be much reduced if the drive can be taken from a lineshaft. The initial outlay will, however, have to be increased to provide a range of milling cutters and arbors ; moreover, the cost of resharpening the cutters must also be taken into account.

The small hand-shaper or planer is much less

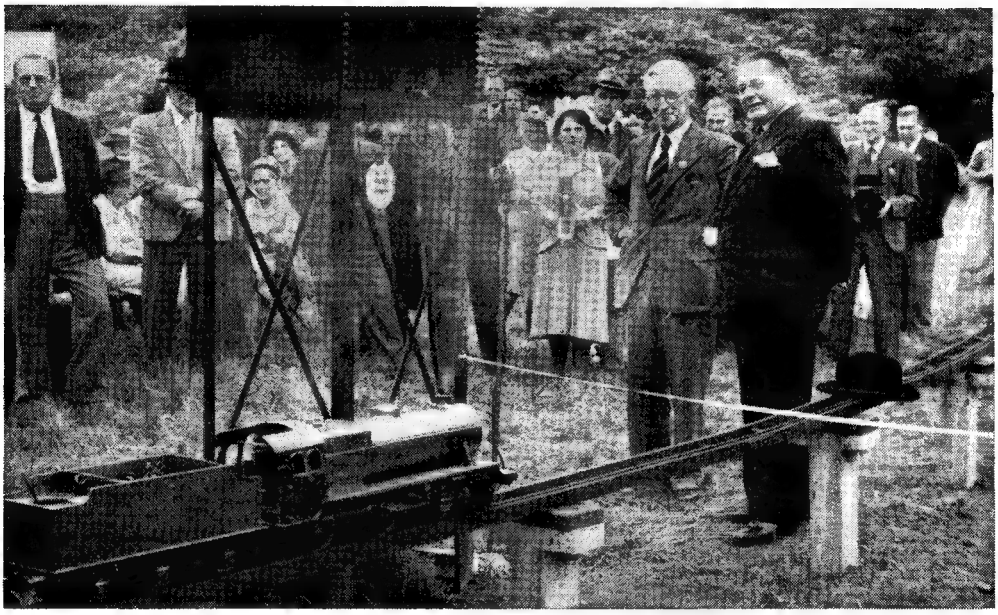
costly, but before selecting a machine of this type, it is advisable to make sure that its capacity is adequate for the work intended.

The power-driven shaping machine, of the kind used commercially, is, as a rule, rather less expensive than the corresponding milling machine, and after the initial outlay, no additional expenditure may be needed for providing and maintaining the necessary cutting tools.

From these notes it may seem that a good case has been made out, on behalf of the small workshop, for the shaping machine in preference to the milling machine, and, although opinions may differ sharply on this issue, there can be little doubt that either machine, preferably power-driven, is a most useful tool in any workshop both in abolishing much heavy filing and in saving time which would otherwise be occupied in setting up the lathe for some special duty.

For those who are unable to make up their minds, the simple and inexpensive tool equipment required for the shaping machine will, perhaps, have a special appeal and may even be the deciding factor.

The Track at Haigh Park, Wigan



THE Wigan and District Model Engineering Society is another of those which are to be congratulated upon the possession of a passenger-carrying track as a valuable means of popularising our hobby; for the track recently completed in Haigh Park is now open for traffic.

The opening ceremony was performed by His Worship the Mayor of Wigan, Councillor A. J. Lowe, and also present were the chairman and members of the Parks Committee, members of the Town Council, the Town Clerk and the Parks Superintendent. There was also a large turnout by members of the society and their friends, whilst visitors included members of the Bolton, Southport and Buxton societies. Great interest was shown by the public, large numbers of whom were present.

Introducing the Mayor, the president of the society, Mr. C. H. Noble, thanked the Corporation and Parks Superintendent for their generosity and help in making possible the project about to be opened, and referred to the hard work done by members of the society.

His Worship expressed his pleasure at being asked to officiate, and whilst admitting to being no engineer, said that he was greatly impressed by the work done on the site and by the exquisite workmanship in the models which he had inspected. He then declared the track open and drove Mr. Noble's new locomotive to break a tape, and much to the delight of spectators completed a full circuit of the track. He was followed around in procession by six other members driving locomotives which varied from a *Rainhill* to a *Hielan' Lassie*.

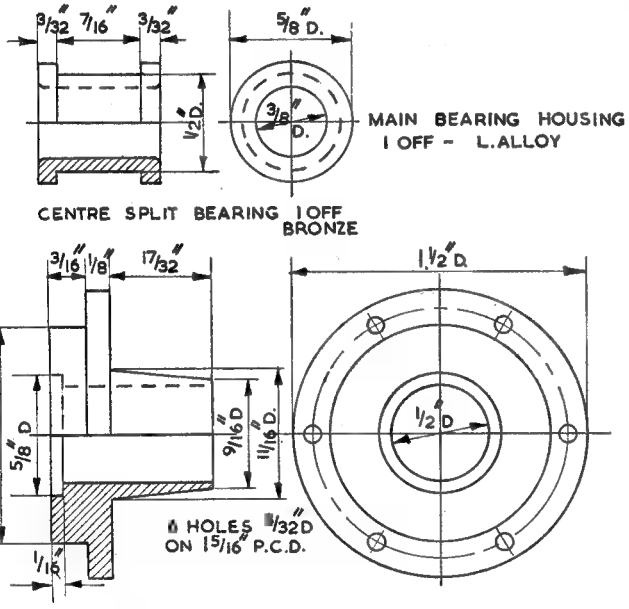
The track is 500 ft. long in 2½ in. and 3½ in. gauges, and is set in most delightful surroundings. The roughly oval-shaped track runs round trees and a fine bank of rhododendrons, and is partly in a cutting. The sight in early summer, when the rhododendrons and azaleas are in bloom, is truly magnificent. Haigh Park was formerly the home of the Earl of Crawford and Balcarres.

PETROL ENGINE TOPICS

*A 10 c.c. Twin Four-Stroke

by Edgar T. Westbury

IN describing the crankshaft bearing bushes before the housings into which they fit, I have perhaps been guilty of putting the cart before the horse, ■ it is obviously desirable to machine the latter first, if only in case it may be necessary to adjust the external diameter of the bushes to bores which are not dead accurate to the specified size. Most constructors, however, will have their own ideas as to the order of procedure in machining operations, and there are several factors which may affect convenience, or even dictate the sequence of these operations.



Main Bearing Housing

This part may either be made from a casting or machined all over from solid light alloy bar of ■ size large enough to clean up to 1½ in. diameter. In either case, the work is quite straightforward, and the essential part of the machining can be carried out at one setting. If ■ casting is used, it can be gripped on the rim of the flange in the four-jaw chuck, with the register face outwards, and the nose passing into the bore of the chuck; only the tips of the jaws can be used, as it is necessary to be able to machine the full length of the register and the face of the flange without fouling the jaws. After facing the end to finished dimensions, it should be deeply centre-drilled, then drilled, bored, reamed and counterbored to take the bush. The register is then turned to fit neatly in the bore of the crankcase assembly, and to a length of $\frac{3}{16}$ in., leaving ■ sharp corner and ■ clean flange face.

The job may now be reversed, and either mounted on ■ mandrel, or held by the register in the three-jaw chuck, with ■ strip of foil to protect it from marking by the jaws, for skimming the outside of the flange, and the outer face of the latter, to give a true bearing surface for the nuts or screw heads which secure the housing in place. At the same time, the end of the nose may be faced; the casting should not need further machining on the outside if it is reasonably clean. If the component is made from the solid, ■ similar machining procedure may be employed, except that ■ preliminary roughing-down operation on the nose is desirable, to save heavy cuts in the later stage, when it may not be possible to hold the work very securely.

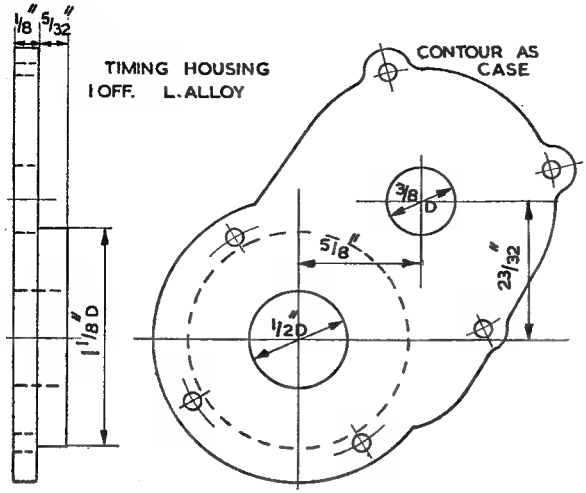
Timing End Housing

This part may be held by the rim in the four-jaw chuck for the main operation, or alternatively, clamped against the faceplate for facing the register spigot and boring, all subsequent work being located off bore by mounting on a true-running mandrel. In either case, of course, the spigot should be set up to run truly, both concentrically and on the face. It should be noted that if the engine is to be adapted for running in the reverse direction, the spigot must be on the other side to that shown in the drawing. As before, the outer diameter of the spigot should be turned to fit closely in the bore of the crankcase at the appropriate end, and the flange machined truly flat so that it beds firmly against the face of the crankcase when in position.

Chuck or mandrel mounting may be used for facing the reverse side, the essential thing being that the surface should be truly flat, and the thickness of the flange uniform all over.

A feature of the two main bearing housings which is not specified in the detail drawings, but

*Continued from page 415, "M.E.," September 14, 1950.

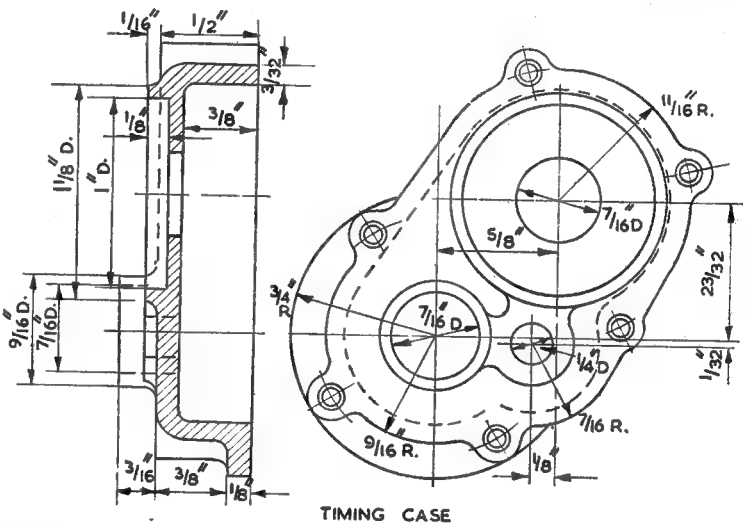


end play. It may be found necessary to adjust the latter by taking a skim off one or other of the bearing faces, or, if more convenient, off the crankshaft webs.

Another desirable provision is the drilling of vent holes through the timing end housing to allow the passage of oil mist ; three equidistant ⅛ in. holes, as near the edge of the spigot as possible, are recommended, one being at the lowest point to allow any oil collected in the timing case to drain back to the crankcase.

Timing Case

The main machining operation on this part is a plain facing cut on the inner joint surface. Note that this casting may be " handed," if desired, to produce reverse rotation of the engine. When the face is machined, and lapped, if necessary, to ensure that it beds truly against the face of the timing housing, the two parts should be drilled to take the fixing studs, and



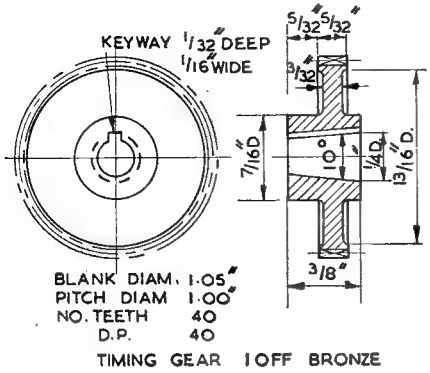
TIMING CASE
1 OFF. L.ALLOY

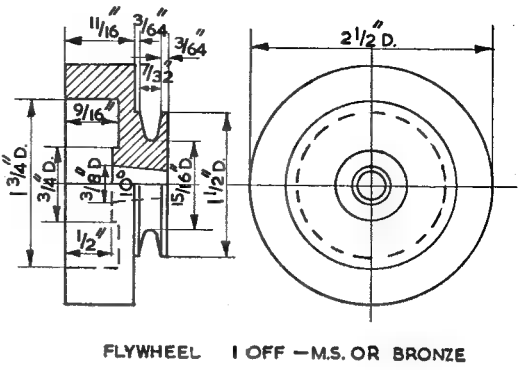
which is highly desirable, is the provision of 3/32 in. drilled oilways at such an angle that they enter about the middle of the bushes in each case, and run right into the bore of the latter. The top of the register spigot should first be chamfered at approximately the correct angle to facilitate starting the drill, and the hole is afterwards countersunk to assist in collecting oil and conveying it to each of the bearings.

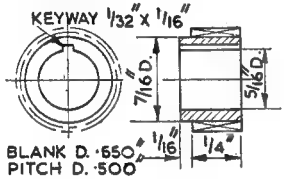
In the case of the split centre bearing, two holes can be drilled at an angle from the inside of the seating to emerge on either side of the crankcase partition ; they can be countersunk by means of a long cutter or drill entered through the bore of the cylinder seatings. A locating dowel should be fitted in the lower half-bush and the cap, to prevent the risk of the bearing creeping round and putting the oilways out of line. All these operations should, of course, be carried out after the crankshaft has been fitted to its bearings and made to run smoothly, with the minimum amount of

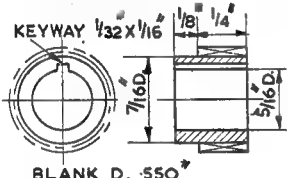
secured temporarily in place on the engine crankcase. It is necessary to adjust the angular position of the timing case to ensure that the contour coincides with that of the housing flange, and the latter must be located correctly relative to the camshaft tunnel ; if desired, a small hole may be drilled to indicate as nearly as possible the centre of the camshaft, but this should not be opened out to full size at this stage. The hole may be sighted from the other end of the camshaft tunnel to assist in locating the position of the housing.

When the timing case and housing are attached to the crankcase, a ½-in. pin mandrel should be turned in the lathe chuck, and the entire assembly mounted on it ; a " wringing fit " is sufficiently tight for present requirements. The lathe is run at moderate speed—it will not be in perfect balance unless some provision is made for balancing by attaching weights to the crankcase—and the end of the timing case may be centre-









drilled, bored and faced, with the assurance that the hole will be in perfect alignment with the shaft bearings.

A similar method may be used to bore the camshaft bearing seating and the contact-breaker housing recess, the mandrel in this case being $\frac{9}{16}$ in. dia. It is advisable in this case to machine the contact-breaker recess first, and drill ■ $\frac{7}{16}$ in. hole centrally through it; the camshaft bearing seating may then be drilled and bored out to $\frac{3}{8}$ in. dia. The hole for the idler gear stud may be left till a later stage in the construction.

Some constructors may wish to obtain the highest possible precision in the relative location of the timing case and housing on the crankcase; it is fully practicable to fit dowel pins between the securing studs if desired, but this has not been found necessary. If the minimum clearance is allowed in the holes, the studs themselves will serve fairly effectively ■■ dowels.

Timing Gears

No doubt most constructors will prefer to obtain these gears ready made if possible, and ■■ they are identical to those of the "Seal" engine, they are already available. It is not, however, ■ very difficult matter to cut plain spur gears in the lathe, and information on this subject has been given on several occasions in the "M.E." Many visitors to the "M.E." Exhibition were very much impressed with the demonstration on the "M.E." workshop stand, in which a very simple milling rig was shown cutting gear teeth on a Myford M.L.7 lathe, as easily as shelling peas. But this was only one of the possible ways in which such jobs may be carried out; all of them are interesting, and none of them justifies the terror with which gear cutting problems are so often regarded by users of limited equipment. It is not necessary to adhere strictly to the gear specification shown; both the material and the pitch of the gears are subject to modification, as the duty on the gearing in this particular engine is not very high. Instead of using 40 d.p. gears, one could use either 36 d.p. (36 and 18 teeth in the spur gear and pinion respectively) or 32 d.p. (32 and 16 teeth), using the same gear centres. With slight modification of gear centres, further latitude is possible, including the use of metric module pitches.

Flywheel

The material for the flywheel may be either mild-steel, cast-iron, brass or gunmetal, according to what is most readily obtainable. It is advisable to rough machine the external surface first, to within $\frac{1}{16}$ in. or so of finished size; then reverse in the chuck for facing the back of the rim, machining the recess, drilling and taper boring the centre hole. The flywheel is then mounted on a taper mandrel for finishing the external surface, including the groove of the starting pulley. By this means it is possible to ensure that when finally mounted on the engine shaft, the flywheel will run perfectly truly; and being machined all over, it should also be in perfect balance, though this is not always correct in the case of castings, which may not be perfectly homogeneous, and in such cases a check on balance is desirable.

In fitting the flywheel to the shaft, great care should be taken to mate the tapers properly, using methods which have been described many times in connection with previous engine designs.

(To be continued)

Light and Colour

by G. W. Allinson

AMONGST the mysteries that confront humanity is the place that decoration insists upon maintaining down the ages.

Since humans resist uniformity with a tenacity that defies death and the concentration camp, no wise man will venture to dogmatise upon anything that relies upon the senses for recognition.

One man's idea of a blissful sound drives the other bloke to rage, one man's ordeal by clashing colours soothes the other fellow to croon a chant of delight—and so on.

It's all ■ matter of demonstration—uniformity is not possible where the eye, ear and the nose register so disgracefully inaccurately.

Talk about tolerance ?

No I will not talk about tolerance, I will talk about the one spot on earth where a man can be ■ intolerant as he likes, where he can work off all the latent fires that burn the minds of masterful men—the lust for power, selfish passions and pride—in that absorbing place, his workshop. That frightful jumble of gaudy gypsy-like pieces of machinery that stand about my workshop are the outward and visible signs of a madness (shall we say?) that spends itself in visual jokes. Prim and proper lathes that once sat quietly clad in battleship grey have become sky blue with gleaming red nobs. My ancient band saw reared its ugly head gnashing its filthy frame in violent protest—on goes a coat of paint and that old frump smirks with delight. So it goes on till all my gear is satisfied. Then I find cobwebs stretching rude hands towards the kingfisher colours that hang about my gay machines —so I paint the walls off-white and the whole now is one light and rowdy workshop.

Gradually and gently the dust and grime of work dulls the herbacious border effect, but it was worth the effort, as far ■ I am concerned.

I have ■ sort of snob-horror of the sleek, rich effects. The dollar grin does not impress me and the decoration " as done by the very latest experts," bores me. What gives me a big kick is the genuine muck up that ■ bloke does to please himself—that true and honest gaiety that splashes off the brush of the man who enjoys what he does—and does it BANG—just like that.

For me a chap's workshop is the one place where he should insist upon being supremely, defiantly and furiously himself. A resolute swashbuckler, swashing buckles like mad. There he can wrench great happiness from chunks of stock, there he learns humility with honest pride, there he can wreck the lives of no one, impose his will on no one or oppress his fellows by organising their lives for them.

Is that ■ small matter ? The world should be grateful.

Some fellows like ■ workshop dirty, dark and full of junk—to them I say go ahead the way you will and ignore the flashy paint pot—the matter of light and colour is in your case ■ irritation—the extra work entailed in cleaning your gear does not appeal to you—why should it ?

You do the job, and you are happy—that's it.

To those who fancy themselves as surgeons on the job, the gleaming tools are all ■ part of the game. Perhaps the few tentative suggestions I make may interest those who enjoy keeping their workshops light, bright and coloured.

I find that the strong natural colours of red, yellow and blue are a bit fierce in large lumps, but my eye enjoys them poking up out of the pale pastel colours that I use on the larger surfaces.

Thus the mobile compressor is a light blue, the prevailing colour in my workshop, with red and black striped wheels and black handles. If I put on ■ colour over the blue it generally indicates something, ■ switch, ■ tap or ■ moving part.

I could not resist doing a little twiddley bit on a perfectly pure and clean leg of my saw bench. Sometimes I make ■ virtue of necessity and use a blemish or a spot of unauthorised paint, to make a lizard or a dragon. These childish things make folk, who come into my workshop laugh like anything—it comforts them to know they are not such fools, ■ subtle form of hospitality, that makes many friends. It is difficult not to be sorry for me, it lulls the jealous stab that always touches the types who would like to own a little heaven, but cannot get up the energy to get busy. The fear of work daunts them.

Decoration need not be without its business angle, for the eye is a strong member of the faculties and influences us far more than we dare admit. It seems ■ cad's trick to lick up a worn-out lathe to sell, but—need I enlarge upon that sleek piece of junk you bought by eye ?

I find the prevalent idea that light-hearted decoration is unseemly, and vulgar, to be based on no tradition, the lack of traditional decorations of machine tools is the imprint of the industrial gloom, that settled with ■ hiss of steam upon the toiling, grimy, folk, who had the misfortune to be born ■ hundred years too soon.

My rustic background has always revolted against the acceptance of the drab as inevitable. I come of the stock who dressed their horses in ribbons and brass and swaggered into the market town, leading or driving ■ team of gleaming horses. The sons of these lads now drive tractors, and it is to be recorded that they insist upon fierce colours that make as much noise ■ their motors.

Now, mark you, gentlemanly, restrained and shocked reader, the back-room boys of industrial research are hot on the trail of light and colour—directors have seen a great light, and our factories are to add colour as ■ mate to the canteen and the playing field. Colour pays they say.

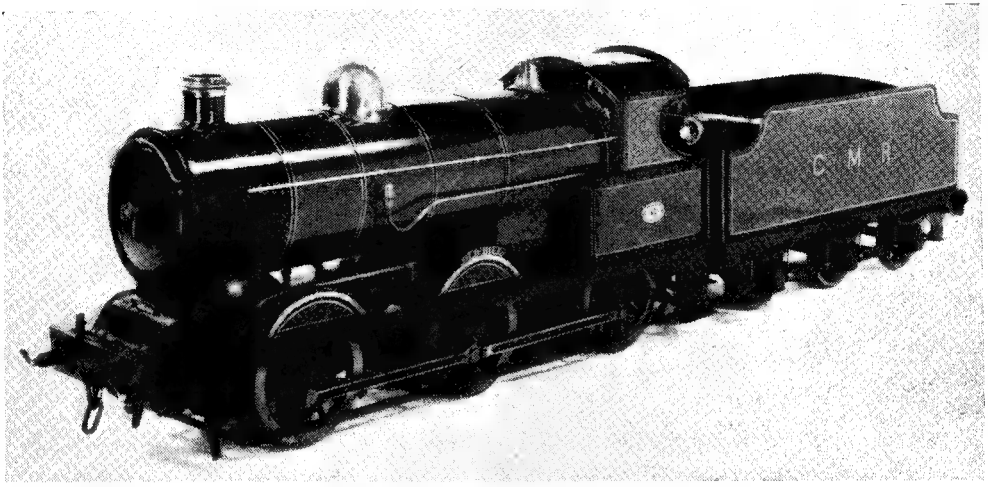
Again the instincts of the ancients have been proved to be sound, the busy back-room boys have found ■ pearl of great price that the com-

(*Continued on page* 502)

Feeding Model Locomotive Boilers

by K. N. Harris

FOR feeding model locomotive boilers in general, I am strongly in favour of an injector. If this is of the lifting type, really dependable, and it is set above the level of its water supply, then you have, in my opinion, the ideal condition. Mr James Crebbin's *Old Bill*—photo herewith—(which distinguished herself in Belfast at an Ulster Society's Exhibition by hauling over 6,800 passengers in the three half days and one whole day that the show was open, a feat which I should imagine is quite without precedent) is fitted with a Linden injector of the lifting type installed in this manner, and it gives just about 100 per cent. reliability; it never fails to "pick up" immediately steam is turned on, it does not dribble at the overflow.

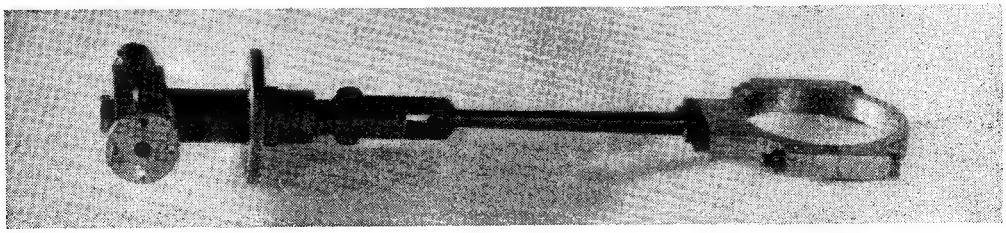


"Old Bill"

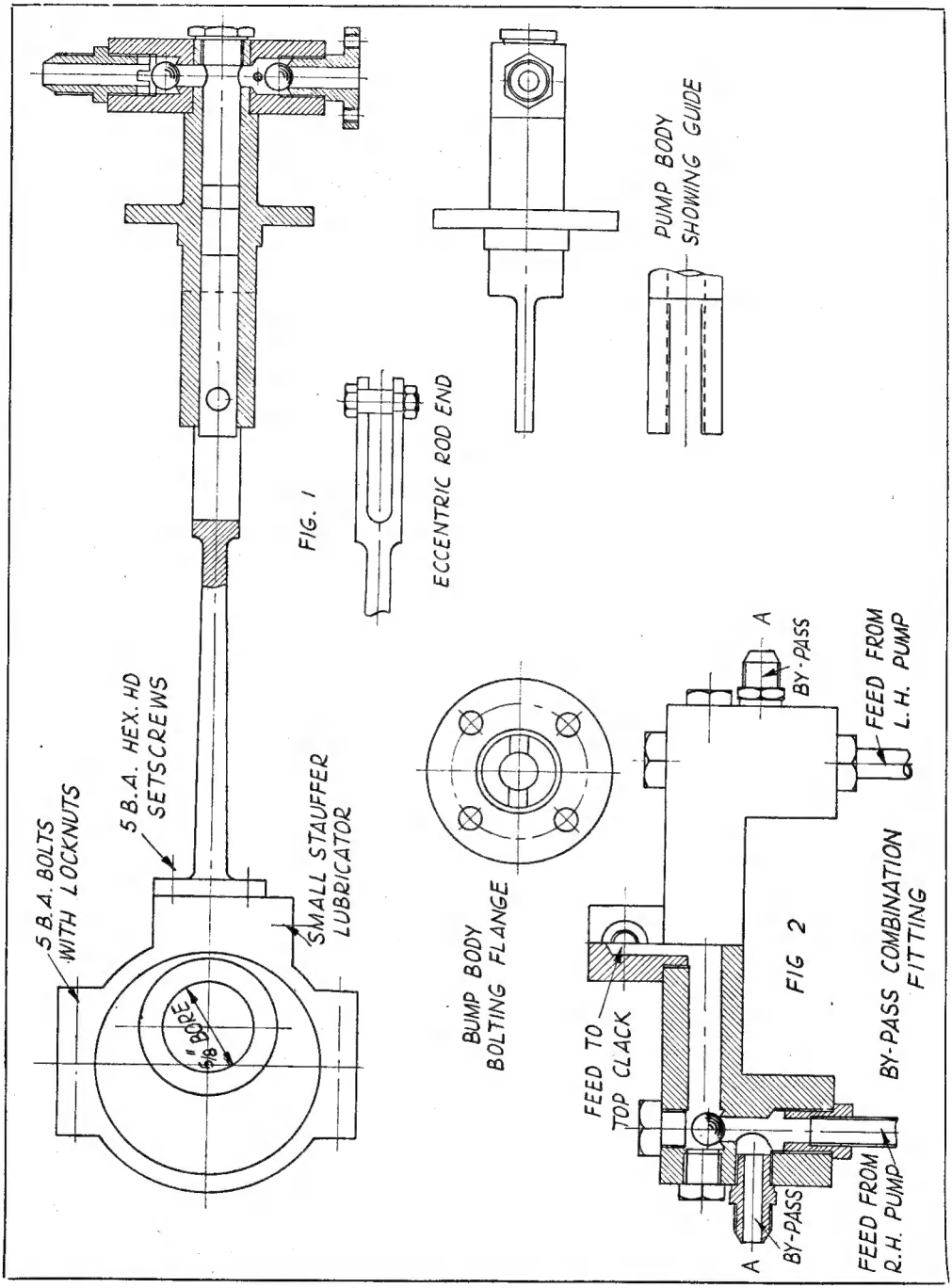
There is a definite advantage in using this type of injector and thus fitting it; at any time water is needed, one simply opens the valve controlling the steam supply to the injector, and feed commences. There is no water-valve to open, adjust, or to (forget to?) turn off when you shut down the injector; just nothing to do but turn on steam (so long, of course, as there is water in the tank; even the very best injectors won't work without water) when you want to feed the boiler, and turn it off when your boiler is sufficiently full.

Now it is all very well for those who spend hours every week driving model locos of various types, to say, "it is easy to drive"; the fact remains that quite a lot of people do *not* find it so, and, that being the case, there is everything to be said for making things as simple for them as possible. Particularly does this apply to locos intended for serious work in public; for it is an unquestionable fact that people *do* forget to turn on the water supply to an injector, and they *do* forget to turn it off; most reprehensible of course, but there it is, a fact to be reckoned with, and that is what the Linden lifting injector does with something as near perfection as makes no matter.

The experiment of deliberately heating such



Eccentric-driven feed-pump

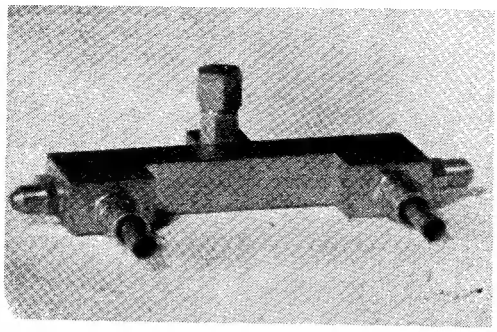


an injector, was actually carried out perfectly successfully by Mr. Victor Harrison, to demonstrate that with a properly designed and made injector, the fact of its getting unduly hot would *not* prevent its functioning. The test was drastic and the proof effective ;it was a perfectly rational demonstration and in no sense a stunt. If buckets of cold water have to be thrown over an injector to make it work, then there is something wrong with its design, construction, maintenance or operation.

One trouble with an injector is that it does not

lend itself to accurate measurement of feed-water when tests are the order of the day, and for this type of work a pump is much to be preferred.

I am building a simple 0-4-0 3½-in. gauge tank engine specially for test purposes, though I hope is performance will be sufficiently good to make it useful for passenger hauling when wanted. It is really a 1¾ in. scale model of an imaginary 2-ft. gauge locomotive of the type suitable for a contractor or other light railway service. As the engine is for test purposes, I am sacrificing convenience in driving for efficiency in checking feedwater consumption and fitting two pumps, eccentric-driven, separately controlled. Actually, I shall probably fit a Linden injector as well, for use when tests are not in question.



By-pass unit

The photograph and drawing give details of the pumps fitted to my engine. The special feature is the provision of an extension guide to the ram, made in such a manner that the wrist-pin always falls within the supported area. This, coupled with the long eccentric-rod, reduces any wear on ram or pump bore to a negligible quantity. To carry out the principle simply, entails the abolition of a packed gland. A packed ram is substituted, in my case of silver-steel, packed with oiled plaited cord, such as is, I believe, used by fishermen.

Stainless-steel ball-valves are used, in combination with knife-edge seatings, which have the advantage that they are less liable to give trouble with dirt getting under the ball than is the case with the more usual type.

The lift of the balls is restricted to something less than 1/32 in. ; this is an important point, not perhaps sufficiently appreciated by many, as it has a considerable bearing on the efficiency of a pump working at high speed. As an instance of this, the White Steam Cars had twin superimposed pumps with a common plunger driven at engine speed which frequently exceeded 1,500 r.p.m.

These pumps used ⅝ in. or ¾ in. bronze balls, and the lift of these was restricted to 1/32 in. only, and it was critical, too. If less, the pumps laboured badly, and if more, they raised a clatter beside which the noise made by an aeroplane engine all out would be peace ; not only that, they rapidly damaged themselves and their seats.

The third photograph shows the by-pass unit, and Fig. 2 a drawing of this. It was desired to be able to have both pumps in action, both out of action, or either one in action, at will, and at the same time to feed to a common pipe to the top-feed fitting. From *A.A.*, pipes are led to needle-valves situated one above each tank and delivering into the tank by a funnel, into which the discharge can be observed.

Probably in model sizes the axle or crosshead-driven pump is the most efficient means of feeding the boiler, and by this, I mean that it does the job with the least net drain on the steam supply. Where the injector and the donkey-pump stand, relative to one another, I have no knowledge ; it would be interesting to have some factual data on this matter from anybody who has carried out experiments under properly controlled conditions.

Light and Colour (*Continued from page* 499)

mercial go-getters overlooked for a century.

I smile rather more than is respectful or kind, for I am not genteel, but terribly vulgar—I laugh like a jackass at my own antics and yours ; we still refuse to trust our own instincts and ideas ; we become so easily impressed with the scientific dictum. We are too modest.

The joke about this " colour in the factory," is that the effect upon production will be only a shadow of what it might be, for some expert will advise on colour and the whole bally show will be dipped into a vat of that one colour. I have seen it done already. The sight is certainly wonderful, it was ALL cream, so that eyes gratefully rested upon the grey floor, or the girl with the red head. No management would so far forget caution as to let each operative choose his own colour—if he desired to do so.

The tremendous effect of the personal interest, the power of gaiety as a natural and proper mate for hard work, could not be expected to emerge till colour and light could take a hand in our daily lives. Do they, will they ?

To you, this may be highfalutin nonsense today, but the little fellow who decorates his workshop will discover tomorrow that he has set a bubbling joy going somewhere in the mysterious depths of his make-up.

Maybe he is reaching back to snatch back something his grandfather inadvertantly let go in the last century—a piece of authentic inheritance, the power to make pigments sing and shout insolent jibes at dull care and grimy toil.

The essence of the thing is that you do NOT get a man in to do it. That may pass for the walls, but not the twiddly bits, for to twiddle you must have a feeling for it, otherwise the thing becomes very dead.

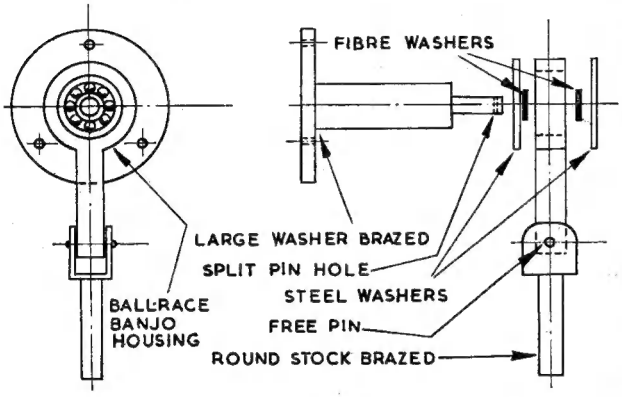
Decorate with the gusto of enjoyment, decorate without fear and may you enjoy every minute of your life in your beloved workshop—as I do, in mine.

PRACTICAL LETTERS

Electric Clocks

DEAR SIR,—With reference to your recent articles in THE MODEL ENGINEER concerning the "Hip" type switching mechanism on the battery-driven clock. I have been experimenting for years on this type of clock and have experienced the same trouble as some of your readers, that is the oscillating or twisting motion of the pendulum when contact is made on the points. For years I tried without much success to stop the unnecessary motion, and I hit on the idea of fitting a parallel ball-race.

This means of suspension I realise is unorthodox, but I have since proved that it is quite successful and would like to pass it on for what it is worth.



Quite a small race was obtained from an *ex*-W.D. source, and the measurements were determined from its size. The housing was cut from the solid with a hacksaw, and filed to shape. The oscillating bracket loosely riveted on the bottom. Either the pendulum proper can be hard soldered or brazed direct on to this, or in my case as I have a hollow pendulum rod, a small piece of round stock, which slips into the rod and is riveted solid.

This hinge as it were, will look after any forward or backward movements of the pendulum and will swing in an angle to the race if necessary. In any case it will save the race from being smashed or damaged if the pendulum is accidently moved in that direction. The suspension bracket is a piece of round stock, turned to fit the inside diameter of the race (step fashion, see sketch) and brazed to a large washer, which in turn is drilled to screw on to the backboard. Large steel washers keep the race and housing in place and a $\frac{1}{16}$-in. split-pin holds the lot together. Small fibre washers the size of the inside diameter of the inner race keep the race from rubbing on the steel washers. Assembled with a spat of soft grease, the assembly will last trouble-free for years.

Yours faithfully,

Slough. G. R. COOK.

Earthing Electric Circuits

DEAR SIR,—On reading Mr. Blackhurst's article on "Workshop Power Supplies," I find he has overlooked one of the most important points regarding the "earthing" of machines. He states that "all machines should be earthed direct on to the conduit," which, of course, is quite correct, but he does not state that the conduit in turn should itself be "earthed," or, in other words, connected to ground.

Thus all machines or motors will be "bonded" together *and also to earth*. The most convenient earth point is the *cold* water tap or pipe, and the conduit of the wiring system should be bonded to this by bare stranded copper wire of at least 7/20 in. size. Connections to the conduit and to the lead water pipe, should be made by copper clamps round the pipe, all paint or rust first being removed with and old file. If no water pipe is at hand for this main earth, a copper plate of about 18 in. square should be buried 4 or 5 ft. deep in the ground, this plate, of course, being connected to the main earth wire. It is advisable to "set this plate in a bed of coke or similar material so as to retain the water or moisture around it." (Stick it under the lily pond, if possible.) I hope the above will clear up a most important point, which, no doubt, Mr. Blackhurst already knows, but did not make clear in his article.

All electrical apparatus should always be effectively bonded to ground, thus any fault developing in the wiring will blow the fuse and isolate the fault from the mains.

A good earth is an essential part of all electrical installations.

Speaking of "earths," I myself have experienced radios "earthed" [?] to a spoon hanging in a jam-jar full of water, or a fork stuck in the plant pot beside the aspidistra. Needless to say. these so called earths can lead to untold danger.

Yours faithfully,

Easington, Co. Durham. T. A. TEMPEST

Mr. Eckert's Miniature Generator

DEAR SIR,—It was with very great interest that I saw Mr. Eckert's very fine model pictured on the front cover of THE MODEL ENGINEER.

I was privileged to be often with him in the S.M.E.E.'s workshop when this engine was under construction and at that time there was an ancient 4 in. Drummond lathe in the workshop which was reputed to be so decrepit that good work could not be done on it. Mr. Eckert said it was still a serviceable tool and to prove it he did most of the turning for the engine on this machine.

I think this should be a great encouragement to those of us whose equipment is not first-class to know that such splendid work can be done without the aid of high-grade precision tools.

Yours faithfully,

Upminster. J. A. KINSMAN.

Prevention of Rust

DEAR SIR,—The letter from E. A. Searles of Rio Grande, brings to my mind a recently introduced fluid for the prevention of rust. I believe this will answer Mr. Searles, need and probably others as well.

This article known as "Ensis" is in oil, fluid, and compound form, and is produced by the Shell-Mex and B.P. Ltd.

"Ensis Oil 452" is a lubricating oil with an anti-rust additive to protect metal surfaces from rust due to condensation, etc., inside i.c. engines.

"Ensis Fluid 256" is a protective which has the ability to displace water from metal surfaces. It is brushed or sprayed on copiously (garden syringe for spray) and removed when required by wiping down with kerosene (paraffin).

"Ensis Fluid 262." This dries with a hard varnish like surface, it does not displace water, but should be used after the 256 fluid to protect surface for a longer period. Apply and remove as for 256.

"Ensis Compound 352." A solid to give even longer protection.

The above items are available in one gallon tins from Shell depots and agricultural suppliers, since they were introduced for protection of farm implements, They cost little more than ordinary lubricating oil.

Notice, however, they are not magic-wands. They cannot remove rust, this must be removed by the usual methods, then the application of "Ensis Fluid" will protect.

The Shell-Mex and B.P. Ltd., produce a little booklet on this product which gives full details of its work and application. An interesting illustration in it shows a piece of cotton wool saturated in water suspended in Fluid 256 with most of the water already at the bottom of the glass, and the last few drops just leaving the cotton wool.

Yours faithfully,

Lymington. C. F. COMPTON

CLUB ANNOUNCEMENTS

Glasgow Society of Model Engineers

The annual general meeting of the 30th session was held on Saturday, September 16th, 1950, in the clubroom at 60, Clarendon Street, Glasgow, N.W.

Meetings to the end of the year are as follow, all at 7.30 p.m.

October 21st. British Railways Film Night.

November 18th. Talk: "The Making of Model Propellers," by a member of the staff of Denny's Experiment Tank.

December 16th. Talk: "C.I. and I.C. Model Engines," by George Leask.

The retiring secretary, John W. Smith, desires to thank all who supported his endeavours over the last twelve years.

The new Secretary is ALAN RODGER, 93, Ormonde Avenue, Glasgow, S.4.

Eltham and District Locomotive Society

The next meeting will take place on Thursday, October 5th, at the Beehive Hotel, Eltham, at 7.30 p.m., when the chairman, Mr. Hutton, will give one of his interesting lectures. Members are specially asked to attend this session, as Mr. Hutton provides a very instructive and interesting talk on valve gears, workshop practice and locomotive building in general.

At the last meeting Mr. Weedon concluded his workshop discussions, which embraced boiler construction design and general methods adopted. It is hoped to continue with the debates in the near future.

Visitors are always cordially invited to the meetings.

Secretary: F. BRADFORD, 19, South Park Crescent, London, S.E.6.

Grimsby and District Society of Model and Experimental Engineers

The first "open" race car meeting was held at the new Cleethorpes track on Sunday, August 27th, and was organised by the above society. The track, which has been constructed by the Cleethorpes Council, was opened by His Worship, The Mayor, Councillor J. Magee, J.P. He stressed the value of model engineering and the interest obtained by the building and running of model cars. Mr. G. Moorby's veteran "M.C.N." Special, with clutch drive, was then placed on the track, held in check by a ribbon. The Mayoress then took the scissors, cut the ribbon and the car glided away to officially open the circuit.

The meeting was run in fine weather and over 2,000 spectators and 39 competitors enjoyed an ideal day's sport.

The competitors were unanimous in their praise of the track, especially the traction afforded at high speeds, and many considered it to be the fastest in the country. Our thanks to all the competitors who travelled long distances to be present, without whom this meeting could not have taken place. Special thanks are due to the Derby club for the loan of the electrical timing apparatus and to Mr. Moore in particula for his assistance in operating it and instructing our member in its use.

Hon. Secretary: J. TARTTELIN, 101, Ladysmith Road, Grimsby.

Keighley and District Model Engineering Society

The society visited Bradford society on September 7th and were given a great welcome. As the president of the Bradford society said regarding our visit "May it be one of many."

We have to announce with sincere regret that Mr. Eric Wadsworth, A.M.I.Mech.E., our founder secretary, is unable to continue in that capacity owing to pressure of work. He will continue in the society as a member and remain on the committee. It is felt that a great deal of the society's success is due to Mr. Wadworth's quiet efficiency.

Meetings are as follows:—

October 6th. Talk and demonstration: "Brush Painting with Cellulose." Mr. Brownless.

October 20th. Lantern lecture: "British Locomotive Stock." Mr. N. Foster.

November 3rd. Question night.

All meetings will take place in the Technical College, Keighley, at 7.30 p.m.

Until a secretary is appointed H. BROWNLESS, 159, Redcliffe Street, Keighley, will accept all correspondence relating to the society.

Ickenham and District Society of Model Engineers

The society is busy completing the plans for the winter programme and it is hoped to maintain the high standard previously set. Interest during the summer has been very keen and meetings have been well attended. The boat-building section is arranging for one extra meeting a month to be devoted to the subject. The society's annual general meeting is to be held on September 29th.

Prospective members should note that our new season opens on October 6th and enquiries should be made to the Hon. Secretary, A. F. DUNN, 27, Ivyhouse Road, Ickenham, Uxbridge, Middx. Tel.: Ruislip 3518.

The Historical Model Railway Society

Meetings have been arranged to take place on October 9th, at 7 p.m., November 11th at 3 p.m., and December 7th at 7 p.m. They will be held at the Stephenson Locomotive Society's headquarters, 32, Russell Road, London, W.14, opposite Olympia (Addison Road) station.

On October 9th, Mr. J. N. Maskelyne will read a paper on "Old-time Locomotives as Prototypes for Models."

Hon. Secretary: A. P. HANCOX, 30, Gillian Park Road, Sutton, Surrey.